

# MOTIVATION, CREATIVITY AND INNOVATION IN DUTCH HIGH-TECH COMPANIES

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MASTER THESIS

ACCOUNTING AND CONTROL

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Date:	20 July 2016

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# 1 Introduction

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In July 2014, employees of Apple, Google, Intel and Adobe filed a class action suit accusing their employers to conspire to avoid hiring another's employees in the period between 2005 and 2009 (Resources, Policy, & America, 2014). This resulted in preventing employees from negotiating better wages and secondary working conditions, because it reduces the competition for employees and lowers the bargaining power and mobility of employees. The total damages of foregone wages of the employees are assumed to be greater than three billion dollars (Elder, 2014).

These firms could not hire valuable employees from competitors, thereby essentially withholding themselves of lost opportunities for innovations and consequently future revenues. Companies can benefit from the knowledge, experience and creative ideas of new employees. Which is the basis of these firms and the high-tech industry in general, because these companies build their products and services atop of ideas and innovations created by other people. This agreement indirectly limits innovation, which makes it counterproductive because the high-tech industry is based on innovation. The agreement lowered the mobility of the employees and increased the power of employment of the high-tech firms, thereby lowering employment opportunities and the survival chance of start-ups. Besides the employees, the firms and the industry in general, the shareholders lost gains in stock, caused by this agreement.

Obviously, the poaching of employees was such a problem that an illegal agreement was implemented to combat it. The loss of employees to rivals can be severe when vital employees are poached, causing projects to delay. A leaving employee results in a loss of talent, knowledge, experience and connections. If there is a vacant spot, replacement has to be hired and trained to be effective in its new position. Furthermore, the loss of employees to rivals could be a sign that employees are not satisfied with their job or employer, which may result in others following.

The no-poaching agreement benefited the companies on the short term and at the cost of their own employees. A better solution for keeping employees working is to provide them with long-term contracts, fair wages and secondary working conditions, instead of restricting their options to leave.

## **1.1 Problem statement**

Employees are important and valuable assets for high-tech companies, because they generate the creative ideas that form the basis for innovation. Enabling employees to be creative and keeping them motivated to be innovative is of important for the long-term success of a company. Motivation is distinguishable in intrinsic and extrinsic motivation, although combinations of varying degrees of the two exist (Gagné & Deci, 2005; Ryan & Deci, 2000a). Intrinsic motivation is performing a task because of the enjoyment and fulfilment in doing so, whereas extrinsic motivation is performing a task because of the rewards or outcomes which arise from completing this task (Deci & Ryan, 2008).

It is essential to understand the effect of intrinsic motivation on total employee motivation because core employees of high-tech firms are already receiving high extrinsic motivators, such as wages and benefits. Basic economics teaches that increasing wages results in workers who are incentivized to be more productive (Bailey, Brown, & Cocco, 1998; Gilchrist, Luca, & Malhotra, 2014; Lazear, 2000). This direct relation is strongest in settings where output is dependent on the simplicity of the task and the commitment of employees (Bonner & Sprinkle, 2002; Kachelmeier, Reichert, & Williamson, 2008; Lazear, 2000). Since intrinsic motivation is the drive to perform a task that comes from within, extrinsic motivators are a relatively easy utensil to motivate employees. It is easier to transfer money to employees than to motivate them intrinsically to produce more output. However, motivating employees with extra monetary incentives can increase total motivation only to a certain extent. Because an increase in wages does not result in an equal or proportional increase in output of for example programmers, managers or creative directors.

At a certain level of compensation intrinsic motivators affects total motivation more than extrinsic motivators (Frey, 1997). For this reason, intrinsic motivators are crucial for high-tech companies because employers are able to affect the intrinsic motivation of their employees. Providing people with autonomy; to enable them to be in charge of their life and job increases their intrinsic motivation (Deci & Ryan, 2008). An example of providing employees with autonomy to increase their intrinsic motivation is the '20% time' maintained by Google in which employees had the opportunity to spend 20 percent of their time on activities they found worth pursuing (Steiber & Alänge, 2013).

Amabile (1997) states that creativity is a crucial component for innovation, since it is the first step in the firm-wide innovation process. Furthermore, intrinsic motivation positively affects creativity (Ahmed, 1998; Amabile, 1997; McLean, 2005). Whereas extrinsic motivation appears to have a negative effect (Amabile, Hill, Hennessey, & Tighe, 1994; Ryan & Deci, 2000b). However creativity is not enforceable, or a result of trying harder (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Kachelmeier et al., 2008). Creativity, and indirectly intrinsic motivation, is an important aspect of the innovation capability of companies.

Innovation is crucial for companies to be able to introduce new processes and new products to adapt to environmental changes (Lawson & Samson, 2001). High-tech companies operate in a highly dynamic environment, which is characterized by fast innovation cycles and global competition. Even in economic recession Amabile (1997) and García-Manjón & Romero-Merino (2012) advise that high-tech firms invest considerably in R&D. In addition, innovation is important for firm growth (Van Looy, Martens, & Debackere, 2005) and is positively related to firm performance (Thornhill, 2006).

The problem boils down to the following: the illegal no-poacher agreement of multiple high-tech firms during 2005 and 2009 limited the natural course of employment, by reducing the bargaining power and mobility of employees, thereby these organizations are withholding themselves and their shareholders from lost opportunities for innovation and future revenues. Innovation is of utmost importance for companies in the high-tech industry and the employees are a crucial component in their innovation process. The lower bargaining power and mobility of employees resulted in the employees receiving lower wages, which can affect their motivation and their creativity and can consequently affect the innovativeness of their employer.

Therefore, the research question is the following:

*“How does the intrinsic and extrinsic motivation and creativity of employees affect the innovation capability of high-tech companies?”*

The aim of this research is to determine the effect of employees’ motivation and creativity on the innovation capability of high-tech companies. Ultimately, the results of this research provide companies with the insight and methods to increase the motivation and creativity of their employees, and perhaps even their innovativeness.

Discussed in the following chapter is literature on motivation, incentives, creativity, innovation and management control systems. These topics are investigated because they are necessary to answer the research question of this thesis. The five concepts are defined and theories on these concepts are presented to display an overview of the current state of knowledge. At the end of this chapter a conclusion and a summary is presented that provides a coherent overview and links the concepts of motivation, incentives, creativity, innovation and management control systems. In addition a visually representation of the preliminary framework of this research is provided.

In chapter three, articles related to the previously mentioned subjects are reviewed and discussed. Of the selected articles a summary, the results and the relevance to this research is provided. At the end of the chapter, a summary of the reviewed articles is presented.

The final framework is introduced in chapter four and the hypotheses are based on this framework. The hypotheses are tested statistically to answer the research question of this thesis.

In chapter five is described how this research is designed and conducted, which constructs are selected to quantify the variables in this research and which sample correctly represents the population. The different measurement approaches of the variables are discussed and an explanation for the chosen measurement tools is presented. In addition, the models for the regression analysis are discussed and presented.

In chapter six, assumptions for factor analysis are tested and the actual factor analysis is performed. In addition, the assumptions for regression analysis are tested and the results of the regression analysis are presented.

In chapter seven, the results of this research are compared to theory. In addition, the limitations, implications and recommendations for future research are discussed. The chapter ends with a conclusion of the results of this research.

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## 2 Overview

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In this chapter multiple theories on motivation, incentives in companies, creativity, innovation and management control systems are presented and discussed. These subjects are linked to provide a comprehensive overview of the literature. The information from this chapter in combination with the reviewed studies in chapter three is used to create the preliminary framework.

### 2.1 Motivation

People work for various reasons, but the motivation to work is present in everyone. According to (Nevid, 2012) “motivation refers to factors that activate, direct, and sustain goal-directed behaviour.” Motivation can be differentiated into intrinsic and extrinsic motivation. Intrinsic and extrinsic motivators have a distinct outcome. Intrinsic motivation is the act of executing something because performing the task in itself is interesting and satisfying (Ryan & Deci, 2000a). Extrinsic motivation is the drive to execute something for either a positive or negative outcome or consequence (Deci & Ryan, 2008).

Theory X and theory Y of McGregor are two theories on workforce motivation. Theory X assumes that employees are lazy, dislike working, avoid responsibility and need to be controlled and supervised in every step of their work. Furthermore, without motivators employees do not work because they do not have ambition. Managers use punishments to motivate employees, therefore this approach creates a hostile work environment. Theory Y assumes that employees enjoy their work, take responsibility and work hard. Employees believe that work is part of their life and, with the right circumstances, want to excel at their job. Furthermore, these employees function without the use of rewards or punishments. Theory Y managers create a trusting environment where employees can develop and use their abilities.

Self-determination theory (SDT) is a macro theory of motivation and personality, highlighting personality development and self-regulation (Ryan & Deci, 2000b). This theory focuses on the degree of self-motivation and self-determination of behaviour. Three innate needs based on “people’s inherent growth tendencies and innate psychological needs” (Ryan & Deci, 2000b) are classified, which nurture personal growth and allow people to function optimal. These innate needs are competence, autonomy and relatedness. Competence is the need to control the outcome and to experience mastery, autonomy is the need to be in charge of your own life and relatedness is the need to interact and to be connected to others (Deci & Ryan, 2008). The feeling of competence and autonomy are fundamental to intrinsic motivation. Relatedness influences the level of intrinsic motivation to a lesser extent.



According to one sub-theory of SDT, organismic integration theory, people internalize external regulations, thereby transforming it into self-regulation. Six forms of motivation exist which vary in the degree of underlying regulatory processes. Amotivated individuals simply lack the intention to act. External regulated individuals perform an activity for a certain outcome and introjected regulated individuals act “through self-worth contingencies” like guilt (Tremblay, Blanchard, Taylor, Pelletier, & Villeneuve, 2009). Individuals who identify through regulation perform an activity because they identify with the outcome of the activity. For integrated regulated individuals performing an activity is a part of their identity but also because they value the outcome. Purely intrinsically motivated individuals perform an activity because of the enjoyment of the activity itself. These types of motivation differ in the perception of whether the reason an individual engages in a behaviour is internal or external, or their locus of causality.

The cognitive model of Thomas & Velthouse (1990) builds on SDT. The tasks of participants in the experiments researched by the SDT model are limited and focus on activities such as playing games. Therefore the cognitive model focuses on “a set of activities directed towards a purpose” because this better reflects real life situations (Thomas & Velthouse, 1990). The results of the authors demonstrate that intrinsic task motivation is what energizes people, the “pull of the task rather than the push of management” (Thomas & Velthouse, 1990). This theory identifies four cognitions that shape intrinsic task motivation: sense of impact, competence, meaningfulness and choice. These factors are influenced by ongoing cycles of environmental events, which influence assessment of the tasks of employees.

In this chapter, motivation is defined and different types of motivation are presented. An overview of theories on motivation demonstrates the differences between intrinsic and extrinsic motivation and their outcomes. This subchapter provides an understanding of how managers can perceive and influence employee motivation. Furthermore, the factors that shape intrinsic motivation are presented and discussed.

## **2.2 Incentives**

Cerasoli (2014) refers to Greene (2010) explaining that incentives are “plans that have predetermined criteria and standards, as well as understood policies for determining and allocating rewards” (Greene, 2010). The motivation-hygiene theory tries to explain how employees should be motivated (Herzberg, 1959). The author identifies factors that satisfy and dissatisfy employees. The satisfaction factors are coined motivators since they provide employee motivation, however they do not affect employee dissatisfaction. The dissatisfaction factors are coined hygiene factors since their absence leads to dissatisfaction, and they do not influence employee satisfaction. If hygiene factors such as wages and job security are missing employee dissatisfaction results. According to this theory,

these two factors are not opposites. “The opposite of job satisfaction is not job dissatisfaction, but, rather, no job satisfaction; and similarly, the opposite of job dissatisfaction is not job satisfaction, but no job dissatisfaction” (Herzeberg, 2003). To motivate employees intrinsically motivators have to be present and hygiene factors have to be absent. Satisfaction factors resemble intrinsic motivators whereas dissatisfaction factors resemble extrinsic motivators. Employees react little to intrinsically motivators if extrinsic motivators are missing (Hafiza, Shah, Jamsheed, & Zaman, 2011) or if the subsistence level of primary working conditions are not satisfied. Providing employees with full autonomy has no effect on their intrinsic motivation, if they receive no wages and cannot pay their bills.

The crowding-out effect is the anomaly that raising monetary incentives can decrease supply of labour rather than increase it (Frey & Jegen, 2001). In situations where non-monetized actions become monetized the value of that activity becomes known. As a result, a penalty for performing an action introduces a cost and benefits assessment based on money instead of moral or social standards. In addition, intrinsic motivation can be undermined by external factors “such as tangible rewards, deadlines, surveillance and evaluations” (Gagné & Deci, 2005) because these factors decrease autonomy. The motivational crowding-out theory predicts that external motivators crowd out or undermine intrinsic motivation (Frey & Jegen, 2001). Because of its negative effect on intrinsic motivation extrinsic motivators can lead to diminished effort and diminished output (Bonner & Sprinkle, 2002).

The effects of rewards on motivation are affected by conditions, such as reward type, reward expectancy and reward contingency. However, the exact effects of these reward conditions on motivation are not clear. Cameron and Pierce (1994) presents experiments with these differing conditions which present contradictory results of the effect of rewards on motivation. The authors state that the effect of extrinsic rewards on intrinsic motivation is not clear, previous studies present contradicting results, as there is evidence for negative and positive effects. The meta-analysis of Cameron & Pierce (1994) indicate that verbal rewards have a positive effect on intrinsic motivation and that extrinsic motivators in general do not decrease intrinsic motivation except for some specific circumstances.

Deci, Ryan, & Knoester (1999) perform a meta-analysis of 128 studies and find “that tangible rewards tend to have a substantially negatively effect on intrinsic motivation.” According to the authors, this effect is caused by extrinsic motivators because they undermine responsibility taking for motivation and regulation. Furthermore, the introduction of extrinsic motivators is commonly accompanied with extra surveillance, evaluation and competition, which have a negative effect on intrinsic motivation.

According to Baker, Jensen & Murphy (1988) performance-related pay schemes are counterproductive because they diminish intrinsic motivation of employees, which experience these schemes as controlling. Wiersma (1992) support this notion, the results of this research indicate that extrinsic rewards decrease intrinsic motivation if they are perceived as controlling. Jenkins Jr, Mitra, Gupta, & Shaw (1998) state that financial incentives positively affect the relation between intrinsic motivation and quantity related performance, however financial incentives do not affect quality related performance.

There is criticism on the negative relation between intrinsic and extrinsic motivation because it can be difficult to identify intrinsic and extrinsic motivators. People think they act without obvious extrinsic reward and thereby implicitly conclude that they are intrinsically motivated, while they could be acting on anticipated future benefits (Cameron & Pierce, 1994). For example, employees experiencing fear of discharge and attribute this to intrinsic motivation (Kreps, 1997).

To conclude, intrinsic motivation and extrinsic motivation do not appear to be in the same continuum and are not necessarily opposites. In order for intrinsic motivators to be effective, a minimum level of extrinsic motivators needs to be present. There is no evidence that a minimum level of intrinsic motivation has to be present in order for extrinsic motivators to be effective. However, there is evidence of the crowding-out effect on intrinsic motivation with the introduction of extrinsic motivators. However, the exact effect of extrinsic motivation on intrinsic motivation is not clear. Intrinsic motivation is an important factor for employee motivation, but it is more complicated to influence or improve the intrinsic motivation of individuals than it is to influence or improve their extrinsic motivation (Frey & Jegen, 2001). However, the effort to motivate employees intrinsically is beneficial for both the company and the employee. Because people who are intrinsically motivated have relatively more confidence, self-esteem, persistence, general well-being, and they are more creative than people who are extrinsically motivated (Ryan & Deci, 2000b). According to Hammond, Neff, Farr, Schwall & Zhao (2011) intrinsic motivation is even positively related to individual level-innovation.

### **2.3 Creativity**

Creativity “is the generation of novel and useful ideas” (McLean, 2005) and is crucial for company-wide innovation, which captures, utilizes and markets these useful ideas. De Jong & Den Hartog (2007b) state that intrinsic motivation positively affects creativity and so do Ahmed (1998) and Bonner & Sprinkle (2002). Or as one author states: “Intrinsic motivation for creativity is much more powerful in producing creative behaviour than extrinsic motivation” (McLean, 2005).

Woodman, Sawyer & Griffin (1993) propose a model in which creativity is based on the behaviour of a person in a given situation. According to the authors, creativity is dependent on five

conditions. First, antecedent conditions or biographical variables, influence personality and cognitive characteristics. Second, personality factors including traits such as integrity and curiosity are traits creative people have. However, there does not exist a complete list of traits of creative people. In addition, it is not possible to determine the effect of certain traits on creativity, although there are people who are generally more creative than others are. Third, cognitive factors such as cognitive style and cognitive ability need to be present. There is no definitive list, but a creative individual should have a divergent, balanced with a convergent cognitive style. Which means that a person is able to generate many ideas but is able to arrive at the correct solution. Furthermore, the cognitive ability of a creative individual should include field independence, which is the ability to separate the details from the main issue. Fourth, intrinsic motivation and in which autonomy, self-regulation and reward structure have a great influence on the creative outcome of a person. Fifth, knowledge and expertise, technical skills, talent are needed to be creative. Because creativity and innovation is a product based on prior knowledge.

Kaufman & Beghetto (2009) perform research on the classification of creative output. Big-C and little-c are the most studied types of creativity. Big-C creativity is creative output that is outstanding, lasts a long time and is created by well-known creators or 'geniuses'. Little-c is the everyday creative output of people in activities like school, work or hobbies. The distinction with two types of creative is limited; therefore, the authors propose two additional types of creative output. Mini-c entails the understanding of new theories or metaphors by children and/or students. The mini-c provides the category of experiencing understanding for beginners. The Pro-C category is between little-c and Big-C; the creative work of professionals who do not produce the world highest creative output. Whereas Big-C creators are usually posthumously recognized, Pro-C is the development and progressions beyond little-c. Professionals in creative industries are likely to fit in the Pro-C category. However not all people whose creative output fits in the Pro-C category can earn a living based on their creative output. The four-c model conceptualizes the different levels of creativity.

The componential theory of innovation of Amabile (1997) assumes that everyone is creative and is able to produce creative work, however the work environment can influence creativity. On an individual level expertise, creative-thinking skill and intrinsic task motivation is what enables creativity. When these three components are present in a high degree, creativity is likely to occur. Expertise and creative-thinking skill define individual capabilities, but intrinsic task motivation determines what someone will actually do. Amabile (1997) introduces the intrinsic motivation principle of creativity, which states that "intrinsic motivation is conducive to creativity. Controlling extrinsic motivation is detrimental to creativity, but informational or enabling extrinsic motivation can be conducive, particularly if initial levels of intrinsic motivation are high".

In addition, the work environment influences the innovation of the organization and influences the creativity of employees indirectly. The creativity of employees is the basis for the innovation of the organization as it is a major source for innovation. The work environment affects the individual components of creativity and can enable employees to be creative. In addition, the work environment appears to influence intrinsic task motivation of employees the most, because their capabilities are always present and not dependent on the current situation.

In this subchapter, different models on creativity are presented. There are different kinds of creative output, but what is important is that all people can be creative but there are components that enable people to be creative. The work environment is also important because it influences innovation in the organization and employee creativity. In addition, creativity is positively influenced by intrinsic motivation and negatively influenced by extrinsic motivation.

## **2.4 Innovation**

Creativity and innovation are related, creativity is the generation of new and novel ideas whereas innovation is the development and marketization of these creative ideas. These activities occur on the individual or the organizational level. As stated earlier, creativity is a source of innovation and the first stage in the organizational innovation process. Amabile (1988) defines innovation as: “the successful implementation of creative ideas within the organization.” The componential model of Amabile (1988, 1997) provides understanding on innovation. The author presents three organizational factors, which are crucial for innovation. The organizational motivation to innovate indicates the support for innovation of upper management and the organization in general. This motivation to innovate can be the vision of the CEO, which is communicated throughout the organization. Another factor for innovation is the resources the organization provides, which include information, assets and employees. The last factor is the innovation skill of management and includes practices such as providing employees with autonomy and challenging work, goal setting, communication and reward systems.

According to Stewart & Fenn (2006) innovation can help to reach the desired performance or competitive advantage of an organization. However, the authors deem innovation without a strategy pointless, because a strategy to innovate is the result of the organizational motivation to innovate. Lawson & Samson (2001) describe innovation as an organizational capability and define it as “the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders” (Lawson & Samson, 2001). The authors term manufacturing and marketing as mainstream activities and term activities that identify and create new value as newstream activities. Managed with a short to medium term focus, mainstream activities provide the current revenues and are the activities that efficiently create the output of the

organization. Newstream activities compete with mainstream activities for resource, because the results of newstream activities are uncertain. However, successful newstream activities do not provide profits immediately.

The innovation capability is the organizational ability to balance and connect mainstream and newstream activities. This capability enables the discovery of innovations in the newstream activities, which can be incorporated into mainstream activities. Companies introduce innovative services and products building on their competitive advantage if their organizational capability functions properly. Seven elements form the organizational innovation capability (Lawson & Samson, 2001). These seven elements are vision and strategy, harnessing the competence base, organisational intelligence, creativity and idea management, organisational structure and systems, management of technology and culture and climate.

Voss, Chiesa, & Coughlan (1994) introduce a process based model on technology management. Using a top down approach they distinguish four core business processes of innovation; product innovation, product development, production process innovation and technology acquisition (Voss et al., 1994). Product innovation is the process of generating new product concepts, whereas product development is the process of delivering this product concept to the market. In addition, with production process innovation processes are improved and developed. Lastly, the acquisition of technology generates the needed technology for the other innovation processes. The desired outcome of these business processes is an increase in performance. The right leadership, resources and systems and tools are needed to enable the business processes to succeed.

Coad & Rao (2008) state that there is no clear evidence that a positive relation exists between innovation and corporate performance indicators. This is caused by the time it takes innovations to become marketable. Thornhill (2006) finds that firms in the high-tech sector introduce more innovative products than firms in the low-tech sector and that innovation is positively associated with firm performance. The findings of García-Manjón & Romero-Merino (2012) are similar, the authors state that R&D investments are positively related to firm growth and suggest that firms in the high-tech sector should invest heavily in R&D, even in times of recession. Van Looy et al., (2005) state that innovation is critical for the survival and growth of a firm. De Jong & Den Hartog (2007b) state that individual innovation is an important factor for organizational success.

This chapter defines the innovation capability of companies and presents effects of innovation on firm performance. The relation of innovation capability of an organization and mainstream and newstream activities are explained. Furthermore, different types of innovation and a model that relates the innovation with individual creativity are presented.

## 2.5 Management control systems

Companies need a strategy to ensure their long term viability and to coordinate actions of individual business units in accordance to those of its competitors (Langfield-Smith, 1997). As described in the previous chapter, innovation is crucial for organizational success and therefore requires continuous effort and attention. When companies are challenged by unforeseeable events in their environment, they adjust their strategy. Results need to be analysed to determine the strategic course of the organization and to notice strategic deviations. However, the strategy of an organization is intangible and not directly quantifiable. Therefore, companies have systems that evaluate the performance of the use of its resources, and by doing so evaluate its strategy indirectly.

These management control systems (MCS) are information driven and based on information derived from accounting tools. Simons (1994) defines MCS as “the formal, information based, routines and procedures used by managers to maintain or alter patterns in organizational activities”. These systems are provide the organization with tools to monitor, and when necessary to reactively adapt their strategy, if they are integrated effectively. The author states that MCS are grouped, “according to their relationship to strategy and use by top managers” (Simons, 1994). These systems the following: belief systems, boundary systems, interactive control systems and diagnostic control systems.

The control systems include both formal and informal controls. The formal controls are the most visible controls, such as rules and accounting systems. The informal controls are not necessary physically present and include unwritten rules and procedures. According to Simons (2013) managers use MCS to balance tension that occurs while conducting business. The three elements that create tension are “between (1) unlimited opportunity and limited attention, (2) intended and emergent strategy, and (3) self-interest and the desire to contribute.”

An example of MCS are performance measurement systems (PMS), which are a “set of metrics used to quantify both the efficiency and effectiveness of actions” (Neely, Gregory, & Platts, 2005). PMS consist of multiple individual performance measures, which include output, quality, time, flexibility and cost. There is no single measure that captures the performance of all companies, or a mix of measures that correctly captures the performance of one organization. Therefore, what is important for an organization is what should be measured. In service companies, PMS can capture financial results and other determinants of organizational performance, such as innovation and quality (Neely et al., 2005). PMS as a diagnostic control system can be used as a measurement tool, but it can also be used for strategical change when it is supplemented with interactive control systems, because these systems can help to initiate dialogue (Henri, 2006). Among the MCS are incentive and compensation systems which reward employees for their effort and commitment (Simons, 1994), and thus align the interests of the company with interests of the employees. These control systems function as mechanisms to motivate employees, as the rewards of employees are linked to their performance.

What is evident is that companies need to have a strategy. An organization without a strategy has no right to exist. Furthermore, an organization is not innovative by accident, being innovative takes commitment and is a strategic goal in itself. Management controls systems are important instruments for organizational goals. Diagnostic control systems measure organizational performance and thus indirectly reflect the achievement of organizational goals. However, diagnostic control systems only generate data, but in combination with interactive control systems, the obtained data can be used to help with decision-making processes.

## **2.6 Conclusion of overview**

The goal of this research is to explore the effect of intrinsic motivation and creativity on the innovativeness of the organization. In the previous subchapters, the concepts of and theory on motivation, incentives, creativity, innovation and management control systems are presented. These subchapters provide a thorough and whole overview on the relevant subjects.

The overview is introduced with two theories on workforce motivation in which one assumes that people are either inherently lazy, have no ambition and need to be punished in order to be motivated. The other theory assumes that people work because they enjoy their work in itself, are capable and perform without introducing rewards. These two theories are extremes on the motivation of employees, and require different management styles.

Self-determination theory focuses on the degree of self-motivation and self-determination of behaviour. Three innate psychological needs are classified which are competence, relatedness and autonomy (Deci & Ryan, 2008). Optimizing these three innate needs nurtures personal growth and allows people to function optimal. Furthermore, based on underlying regulatory processes of individuals, six forms of motivation can be classified.

Motivation is the reason why people engage in a certain behaviour, incentives are the means used to motivate people to engage in a certain behaviour. According to the motivation-hygiene theory, there are factors, which dissatisfy and satisfy employees (Herzberg, 1959). The satisfaction factors cannot influence employee dissatisfaction, and the dissatisfaction factors cannot influence employee satisfaction. Extrinsic factors such as wages and status cause dissatisfaction when they are not present. Intrinsic motivators can increase satisfaction or motivation, but they cannot affect the dissatisfaction or decrease in motivation that occurs when the minimal level of extrinsic motivators are not present. Employees are only intrinsically motivated when the dissatisfaction factors are absent and the satisfaction factors are present.

Frey & Jegen (2001) state that extrinsic motivators affects the level of intrinsic motivation. However, according to the motivation-hygiene theory, intrinsic and extrinsic motivation does not affect each other, because they are not in the same continuum. Kachelmeier et al. (2008) state the



relation between intrinsic and extrinsic motivation is not clear, but that they are not necessarily antagonists.

Fostering intrinsic motivation appears to be an excellent way of motivating employees, but the components of intrinsic motivation are hard to influence. Intrinsic motivation is especially hard to influence compared to extrinsic motivation, which can be influenced with extra wages or bonuses.

Woodman et al. (1993) present a model on individual creativity, which is based on knowledge, intrinsic motivation and biological, personality and cognitive factors. Amabile (1997) states that everyone can be creative, but that expertise, creative-thinking skill and intrinsic task motivation is what influences and enables creativity. Intrinsic motivation has a greater positive effect on creativity than extrinsic motivation (Ahmed, 1998; Bonner & Sprinkle, 2002; De Jong & Den Hartog, 2007a). According to Amabile (1997) the role of intrinsic motivation great it is what determines what a person will actually do.

Creativity is the first step in the innovation process because it provides input and is a major source for innovation (Amabile, 1997; Lawson & Samson, 2001). Creativity is a crucial component in the innovation process of an organization, however much work has to be done to develop, implement and ultimately market a creative idea.

The innovation capability of an organization is an important factor for organizational performance (Henri, 2006; Thornhill, 2006; Van Looy et al., 2005). According to Lawson & Samson (2001) an organization has mainstream activities, which efficiently creates output from the firm's raw materials. The firm also has newstream activities, which compete for resources with the mainstream activities and are responsible for identifying and creating new value for customers. The mainstream activities are managed with a short-term focus, while the newstream activities need to be managed with a long-term focus. The innovation capability is the ability to balance and connect these two activities, as it allows the firm to continue its current business in combination with producing innovative products. There are four business processes of innovation, which are; product innovation, product development, production process innovation and technology acquisition (Voss et al., 1994). These business processes can only succeed and result in an increase in organizational performance with the right leadership, resources and systems and tools.

An organizational strategy is needed to ensure the viability of a firm and to sustain and grow its competitive advantage (Langfield-Smith, 1997). The success of innovation is dependent on the strategy of an organization, because innovation without a strategy is pointless (Stewart & Fenn, 2006). Innovation in itself is challenging, however innovation has to be an extension of current business products and processes or a deliberate pursuit of new business prospect. The strategy of an organization is hard to evaluate due to its intangible nature. Therefore, management control systems monitor firm performance and, indirectly, the strategy of a firm (Langfield-Smith, 1997).

The different concepts of motivation, creativity and innovation are defined and the composition of these concepts is explained. Furthermore, these concepts are elaborated with different theories and linked to create a foundation for this thesis. In the following chapter, a number of studies are reviewed. Together with the information from this chapter the hypothesis of this research are introduced. The image below is a visual representation of the theories that are discussed in this chapter. In the model, the boxes with the blue dashes are on individual level and the boxes with the white background are on organizational level.

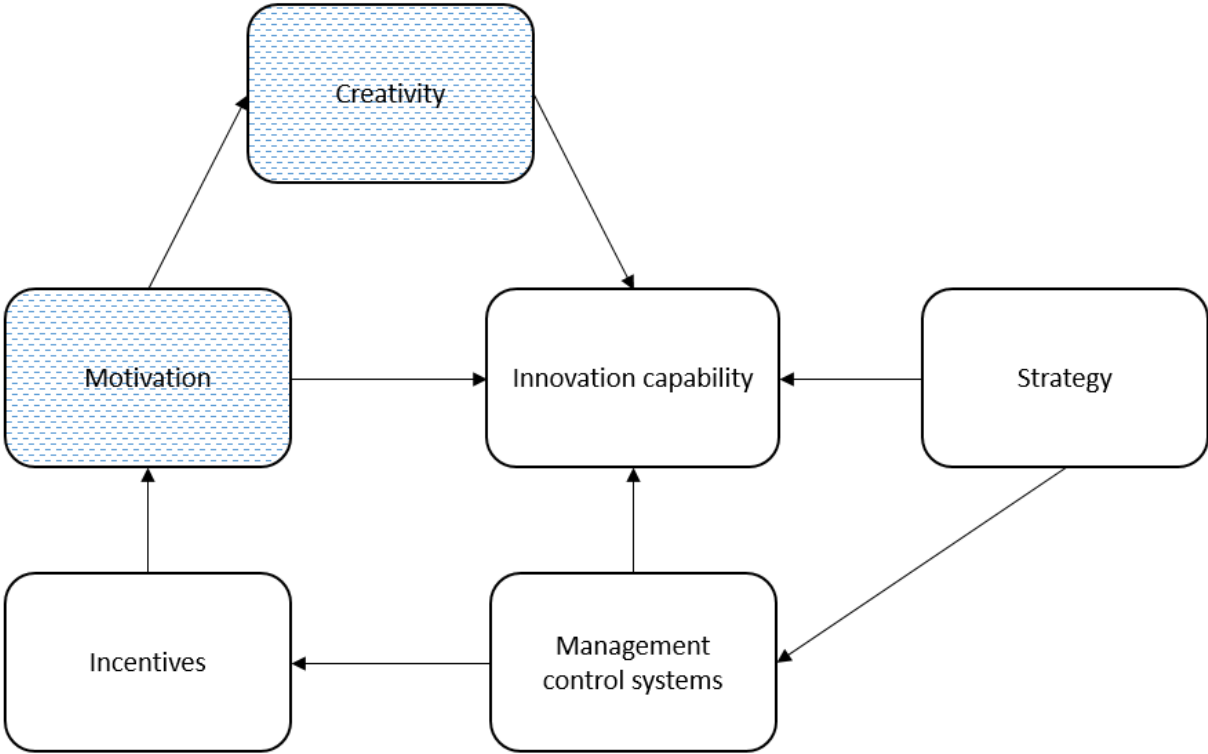


Figure 1 – Preliminary framework.

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### 3 Review

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In this chapter, articles related to the subjects presented in the previous chapter are reviewed. Combined with the information of the previous chapter, this chapter provides the foundation for this thesis. Of each reviewed article is a summary, the results and the relevance presented. The subjects of the articles are related to motivation, incentives, creativity, innovation and management control systems.

#### **Motivation**

First, Amabile et al. (1994) try to measure the motivational orientation of people, and how intrinsic and extrinsic motivation makes people act. Earlier research from Amabile introduces the work preference indicator, a measurement tool that is used to determine the motivational orientation of individuals. This test consists of 30 items answered on a four-point scale and indicates the extent to which people are intrinsically or extrinsically motivated. Intrinsic motivation is divided into challenge and enjoyment, and extrinsic motivation is divided into compensation and outward recognition. The data is collected over the course of eight years and includes 1.363 undergraduates and 1.055 working adults. The participants are students, from different ages and study years, and working adults from varying industries including professional artists and scientists. The measurement tool is adapted to include extrinsic motivators relevant for both students and working adults.

The results indicate that intrinsic and extrinsic motivation correlate slightly, but are relatively independent. Furthermore, it appears that in employees seniority decreases intrinsic motivation, and that relatively intelligent students are more intrinsically motivated than their peers are. The intrinsic motivation of art students is positively correlated with their dedication and their score of predicted lifelong involvement in art. Whereas extrinsic motivation indicates the opposite relation between intrinsic motivation and dedication and lifelong involvement in art. Senior scientists and professional artists have higher intrinsic motivation scores than the general population, since these career choices are for people who consciously choose pursue this career. The research indicates that intrinsic motivation is positively related to creativity, and negatively related to extrinsic motivation. In addition, the authors state that the two types of motivation do not necessarily undermine each other.

This article offers insight how to capture individual motivational orientation. Furthermore, the results from this research offer factors, which influence motivation, such as seniority, intelligence and even career choice.

Second, Dysvik & Kuvaas (2013) explore the role of intrinsic and extrinsic motivation and achievement goals as a predictor of increased work effort. Achievement goals are distinguished in mastery and performance goals. The focus of mastery goals is on developing the competence to complete a task, while the focus of performance goals is on demonstrating competence relative to others. Thus, the achievement goals of employees are categorized into obtaining competence (approach) or avoiding incompetence (avoidance). These two categorizations create four types of achievement goals: mastery approach, performance approach, mastery avoidance and performance avoidance.

Intrinsically motivated individuals who have a mastery approach want to achieve their current task and develop their skills for future tasks, which increases work effort. In this research, it is hypothesized that the relation between intrinsic motivation and work effort is moderated by mastery approach goals. Extrinsically motivated individuals who are performance approach and performance avoidance orientated focus on their performance compared to others, which increases work effort. Therefore, it is hypothesized that the relation between extrinsic motivation and work effort is moderated by performance approach goals and performance avoidance goals.

The data used is gathered by administering a survey on 1.411 employees from three large Norwegian service companies over a two-year period. Intrinsic motivation and extrinsic motivation are measured using respectively six and four Likert-items, which are developed and used in previous studies. The four types of individual achievement goal orientations are measured using scale items and validated by previous research. Work effort is measured by using five items on the effort employees put in their jobs.

The results indicate that the relation between intrinsic motivation and work effort is greater for employees with high mastery approach orientation. The other hypotheses are not supported, although there appears to be a relation between extrinsic motivation and work effort of employees with master avoidance orientation. In addition, employees with high intrinsic motivation appear to have high levels of work effort.

### **Incentives**

Third, Kachelmeier et al. (2008) examine the effect of various performance-based compensation schemes on performance, with performance measured in these compensation schemes as quantity, creativity or a combination of both. The authors want to determine to what extent incentives for creativity and quantity affect performance measured as quantity. The same question holds for performance measured as creativity and the combined performance measurement.

In the experiment, 78 business students participate and they have to create rebus puzzles. The control group receive a reward independent of their output and they are informed that the researchers

measure and reward quantity and creativity. The quantity group receive a reward dependent on the number of puzzles created, relative to average number of puzzles created in the group. The individual that creates the most puzzles receives the highest monetary reward, and so on. The creative group is informed that their puzzles are rated on the sum of creativity of each puzzle, divided by the total puzzles they created. These participants are awarded according to their creativity score relative to the group. The last group is rated on the combined performance measurement of creativity and quantity. They receive the same information as the quantity and the creativity measurement group, but with the addition that the measurements are weighted equally.

The results display that quantity incentives have a positive effect on quantity performance, whereas the effect of quantity incentives on creativity is negative. Furthermore, quantity incentives have a negative effect on creativity ratings whereas quality incentives have a positive effect on creativity ratings. The results for the weighted creativity and quantity performance measurements are not as was expected. The highest weighted score is reached within the quantity incentives group, lower scores are reached in the group that is incentivized for both creativity and quantity. The creativity incentivized group and the control group score the lowest.

Overall, what is measured and rewarded is what results from the effort of individuals. Quantity incentives result in higher quantity performance, creativity incentives results in higher creativity performance. However, quantity incentives cause better results than the incentives for combination of both quantity and creativity. Probably because the group with the weighted incentives prioritize the production of highly creative puzzles, thereby missing the weighted score gain of the omitted mediocre puzzles.

The results of this research indicate that performance based incentives affect the performance of individuals. Incentives for quantity results in higher quantity performance, incentives for creativity result in higher creativity performance. Thus, the performance indicator that is valued by companies should be matched with a corresponding incentive scheme.

Fourth, many researchers have investigated the effect of extrinsic motivators on intrinsic motivation. Cameron & Pierce (1994) perform a meta-analysis because the results from previous research is contradictory. The authors want to determine what the effect is of rewards on intrinsic motivation, and what the effects are of reward types, reward expectancy and reward contingency on intrinsic motivation. Two studies are conducted, the first with a between subjects design, to determine the overall effects of extrinsic motivators on intrinsic motivation, and the second with a within-subject design, to determine the effect of reinforcement on intrinsic motivation. Ninety-six studies are selected that include intrinsic motivation as the dependent variable. Five studies with a within-subjects

design are selected to determine the effect of reinforcement on intrinsic motivation. The selected studies are read and coded, with a second author checking to ensure high reliability.

The results indicate that rewards do not significantly increase or decrease intrinsic motivation for three of the four measure of intrinsic motivation. However, rewards do increase intrinsic motivation if it is measured as an attitude towards a task. Although, according to the authors, this relation should be regarded with caution as, it may not be reliable because of a possible interaction effect. Under specific circumstances, the results indicate that individuals who receive verbal rewards demonstrate significant greater intrinsic motivation and individuals who receive tangible rewards demonstrate significant less intrinsic motivation. Expectancy of reward does not affect the intrinsic motivation of individuals and reward contingency does not affect intrinsic motivation.

Therefore, the results of this research indicate that overall, intrinsic motivation is not reduced after the introduction of extrinsic motivators, although there appear to be some specific situations in which a reward can have a positive effect on intrinsic motivation.

Fifth, Cerasoli et al. (2014) perform a meta-analysis study to determine the effect of extrinsic incentives on intrinsic motivation. The authors hypothesize that intrinsic motivation is positively related to quality related tasks and less positively related to quantity related tasks. Furthermore, it is hypothesized that the relation between intrinsic motivation and performance is influenced by the clarity of the relation between extrinsic motivators and performance. In addition, it is hypothesized that extrinsic motivators are the best predictor for quantity related performance and intrinsic motivators the best predictor for quality related performance.

One hundred fifty-four sources are used in this meta-analysis. The data on intrinsic motivation is divided into four categories; autonomous regulation, intrinsic motivation, task enjoyment and free choice task persistence and are merged into the single measure of intrinsic motivation. Variables on performance are divided into measures of quality, quantity or both. Variables on extrinsic incentives are coded as present or absent and are divided into having a clear or unclear relation with performance.

The results indicate that intrinsic motivation is positively related to performance and that this relation is the strongest for quality dependent performance. The clarity of the relation between extrinsic motivators and performance influences the power of intrinsic motivation to predict performance. The predictive power of intrinsic motivation increases if the clarity of the relation between extrinsic motivators and performance decreases. Furthermore, the results indicate that extrinsic incentives are the best predictor for quantity related performance and intrinsic motivation is the best predictor for quality related performance.

This research uses a huge amount of data, which is gathered from many studies. Although there is no consensus on the effect of motivation on performance, the results of the research show the effect of intrinsic and extrinsic motivation on performance.

### **Creativity**

Sixth, Eisenberger & Aselage (2009) examine the effect of rewards on performance pressure, intrinsic interest and creativity. Performance pressure is the state of mind of an individual believing that its performance lags in order to attain a goal. The authors hypothesize that an expected reward is positively correlated to performance pressure and to self-determination, and that both performance pressure and self-determination are positively related to intrinsic interest. Lastly, it is hypothesized that intrinsic interest is positively related to creativity.

The authors perform three studies to find evidence on the proposed relations. In their first study, alumni respond to a questionnaire measuring the before-mentioned variables. The relation between a reward for high performance and performance pressure is positive and the relation between performance pressure and self-determination is positive. Study two replicates the first study with supervisors rating the creativity of the participants. The results of the second study are the same as the first, complemented with a positive relation between intrinsic interest and creativity. Lastly, study three is a within-subject experiment, in which participants perform a creative task and receive a reward for high performance. One group receives a deposit, which must be returned if their performance is not creative enough and the other group receives the reward independent of their performance. The results of this experiment indicate that performance pressure is positively correlated to creativity, although this relation is not significant.

This research focuses on performance pressure and its effect on intrinsic interest and creativity and the results show a positive relation for an expected extrinsic motivator and intrinsic motivation.

Seventh, Bharadwaj & Menon (2000) perform research on individual and organizational creativity mechanisms and the effect of these mechanisms on innovation. Creativity is based on intelligence, motivation to innovate and creativity skills. Furthermore, to be creative and innovative individuals need to risk the desire to appear consistent, comfortable, confident and competent. Therefore, the authors hypothesize that higher levels of creativity mechanisms lead to higher performance in terms of innovation. This same relation is hypothesized for organizational creativity mechanisms. The last hypothesis is a combination of the previous two; greater levels of individual and organizational creativity mechanisms lead to higher performance in terms of innovation.

The data used in this research is gathered from 750 business units of S&P 500 corporations and consisted of 674 respondents who responded via email. The measurements of the constructs are

mostly self-reported. Creativity mechanisms are measured as time spent on creativity and percentage of books read and seminars attended on creativity. Organizational creativity mechanisms are measured by six questions on the approaches, tools and resources used to encourage creativity. Control variables are R&D organizational slack and organizational spending as percentage of sales compared to competitors.

The variables of individual and organizational creativity mechanisms are divided in low and high levels and are grouped to create four pairs. The group with the highest individual and organizational creativity mechanisms has the highest innovation performance compared to the other groups, supporting hypothesis three. The group with low individual and high organizational creativity mechanisms has higher innovation performance than the group with low individual and organizational creativity mechanisms, supporting hypothesis two. The first hypothesis is not supported because the innovation performance of the group with low individual and organizational creativity mechanisms does not differ from the group with high individual and low organizational creativity mechanisms.

The results of this research indicate that the combination of individuals and companies which focus on enhancing creativity have the highest innovation performance. The relevance of this research is such as it explores how creativity mechanisms influence innovation and provides an example of how to measure innovation.

### **Innovation**

Eighth, the study of Naranjo-Valencia, Jiménez-Jiménez, & Sanz-Valle (2011) focuses on the relation between organizational culture and innovation orientation, with a distinction between innovation and imitation orientation. Companies with an innovation orientation actively try to develop and market new products, whereas companies with an imitation orientation have a passive strategy and follow industry leaders. The model of Cameron and Quinn is used to differentiate the organizational culture of firms and this model looks at the internal or external focus of a firm and its degree of stability and control. In addition, four characteristics of the organization are used and measured to define four types of organizational cultures. These characteristics are dominant characteristics, organizational leadership, management of employees and criteria for success.

The authors hypothesize that an organizational culture with an external focus and a high degree of flexibility and discretion (adhocracy culture) positively affects the innovative orientation of an organization. In addition, it is hypothesized that an organizational culture with internal focus and a high degree of stability and control (hierarchy culture) positively affects the imitator orientation of an organization.

Data is collected from 471 CEO's of Spanish companies who were interviewed personally. The innovation orientation is measured as product and process innovations, and the proactive or reactive



nature of these innovations and the degree to which their innovations counter the innovations of rivals. This measure is combined with the perceptions of managers on the innovativeness of their company. The organizational culture of firm is determined using the 'Organizational Culture Assessment Instrument', although the authors have adjusted it because of the inability to obtain certain data.

The results indicate that an adhocracy culture is positively related to innovative orientation and a hierarchy culture to imitative orientation. The analysis on the dimensions of organizational culture shows that for the adhocracy culture the management of employees has a negative relation with innovation. In addition, for the hierarchy culture the dominant characteristics have a positive relation with innovation. Therefore, for both types of culture, the dominant characteristics have a positive effect on innovation, and for both types of culture, the management of employees have a negative effect on innovation.

### **Management control systems**

Ninth, Bisbe & Otley (2004) study the effect of the use of interactive control systems on innovation and performance. Specifically the authors want to examine the effect of interactive control systems on product innovation and the effect of interactive controls systems on the relation between product innovation and performance.

Data is gathered by surveying top management of 58 medium-sized Spanish manufacturing firms. The authors define three-control mechanisms that determine the interactive use of control mechanisms: budget systems, balanced scorecards and project management systems. The measurement of product innovation is determined by measuring the rate of new products, the degree to which firms innovate in respect to their industry and the share of new products sales in total firm sales. Because firm performance can be measured along different dimensions, the respondents were asked to rate the importance of these dimensions and score their organization on these dimensions compared to industry average.

Results indicate that interactive use of MCS does not positively correlate with innovation. However, dividing the sample into high and low innovators provides unexpected results. The group of low innovators showed no significant correlation with interactive use of MCS. Whereas the group of high innovators showed a significant negative relation with interactive use of MCS, contrary to what was expected. Furthermore, the indirect effect of interactive use of MCS on performance through innovation appears to be non-existent, even when the sample is divided into high and low innovators. In addition, there is a positive and significant relation between innovation and performance when managers use the MCS interactively instead of using it solely diagnostically.

To conclude, the study of Bisbe & Otley (2004) reports on the effect of the use of MCS on firm innovation and performance. Furthermore, this research provides insight in how to capture firm innovativeness and what the differences in results are when differentiating the sample in high and low innovators.

The review chapter is concluded in the table on the next page.

Summary table of reviewed articles.				
Authors	Object of study	Sample	Research Methodology	Results
1. Amabile et al. (1994)	The Work Preference Indicator (wPI) is used to assess the differences of individual's intrinsic and extrinsic motivational orientations, and its validity is tested.	Two samples: student sample and adult sample. 1,363 undergraduate, from a small U.S. university, mostly from psychology classes. And 1,055 working individuals gathered over eight years, working in various industries.	Survey based research with data collected from the wPI and additional instruments. The data was used to identify primary and secondary factors, test the reliability and stability of the scores and the relation between wPI scores and measure of personality, attitude, perceptions and creativity.	The results indicate that the wPI is a stable measure for determining the motivational orientation of individuals. Variables such as age, intelligence and profession do influence the intrinsic motivation of individuals, but there appears to be no negative relation between intrinsic and extrinsic motivation.
2. Dysvik & Kuvaas (2013)	Research on intrinsic and extrinsic motivation as predictors for work effort and the moderating role of achievement goals.	Data obtained twice over a two year period from 1,441 employees from three large Norwegian service organizations.	Survey based longitudinal research in intrinsic and extrinsic motivation and work effort are measured on a 5-point Likert scale with items previously used in validated in other papers. Achievement goals are categorized by their focus on either mastery or performance and either obtaining competence or avoiding incompetence.	Relation between intrinsic motivation and work effort is greater for employees with high mastery approach orientation. The other hypothesis are not supported, although there appears to be a relation between extrinsic motivation and work effort of employees with master avoidance orientation. Employees with high intrinsic motivation display high work effort.
3. Kacelmeyer et al. (2008)	The effect of varying performance based compensation schemes and their effect on performance, measured as quantity, creativity or a combination of both.	78 business students whom participated voluntarily.	Experimental study in which the goal of the participants was to create rebus puzzles and get a reward according to their relative performance. Information providing how performance is valued is included, creativity, # of puzzles or a combination of weighted average of both. The control group received a reward independent of their performance.	Incentives for creativity and incentives for quantity the respective performance. The highest score is reached with quantity incentives, than the weighted average group. The lowest scores are from the creativity and control group. What is measured is what will result. Intrinsic and extrinsic motivation are not necessarily antagonists.
4. Cameron & Pierce (1994)	The effects of reinforcement/reward on intrinsic motivation.	96 independent experimental studies for the between subjects design, five for the within-subjects design. 761 studies compared a reward group to a control group on the free-time measure; 64 studies investigated the attitude measure; 11 studies assessed the willingness to volunteer for future studies without a reward, and 12 studies measured performance during the free time period.	Two sets for design for the studies were selected, where all studies measure intrinsic motivation as a dependent variable. The 96 group design studies with different rewards, reward expectancy and contingency were compared to control groups. The second meta-analysis used studies in which subjects served as their own controls, multiple phases. First phase, baseline measure intrinsic motivation, second, introduction of reinforcement, third, with the withdrawal of the reinforcement.	Overall, rewards do not negatively affect intrinsic motivation, in one specific situation individuals spend more time on a task after the reward is withdrawn. Individuals who receive an expected reward for a task spent not less time on it, they even display more enjoyment when the reward is given for a certain level of performance. For simple task, extrinsic motivators do lower spent time and favourable attitude towards the task. The second study did not show any effect of reinforcement on intrinsic motivation.
5. Cerasoli et al. (2014)	The interrelationship among intrinsic motivation, extrinsic incentives, and performance type and incentive contingency	The review spans 40 years of primary data and include 154 studies that were used for the meta-analysis. The studies had to report the effect size for the relation between intrinsic motivation and performance with an independent sample.	Meta-analysis; the data from all studies is coded. The constructs include performance (quality, quantity or both), extrinsic motivation (present or absent) with incentives further divided into directly or indirectly performance-salient, lastly contingency was divided into engagement or completion contingent.	Intrinsic motivation is positively related to performance, more so for quality related performance than quantity related performance. Contingency of incentives is likely to strengthen the relation between intrinsic motivation and performance. Furthermore, intrinsic motivation is a strong predictor of performance. However, this decreases when the clarity between extrinsic motivators and performance increases.
6. Eisenberger & Aselage (2009)	The influence of reward for high performance on experienced performance pressure, intrinsic interest and creativity.	First study, 421 employed alumni of a U.S. university. Second study, 180 others participants, same demographics. Third study, 405 psychology students.	Two field studies and a laboratory study. First study, Likert scale questionnaire on tenure, performance-reward expectancy, performance pressure, perceived self-determination and intrinsic motivation. Second study same is the same as the first, with addition of supervisors rating the creativity of the participants. Third study, experiment with two groups. Both asked to perform a creative task, with one group offered a reward for high performance.	First study, offers of reward for superior performance may increase perceived self-determination and intrinsic motivation. Second study is a replica of the first study, with the addition that intrinsic interest of employees is positively related to their intrinsic interest. Third study, students' performance pressure increases with the offer of a reward, and are more creative. However, this correlation is not significant.
7. Bhatadwaj & Menon (2000)	Research on individual and organizational creativity mechanisms and its effect on organizational innovation.	Data gathered using an emailed questionnaire from 674 respondents of business units of S&P 500 companies.	Survey based research, self-reported measurements of individual and organizational creativity mechanisms and innovation performance. The sample is divided into four groups with high and low measures of individual and organizational creativity mechanisms.	The group with the highest individual and organizational creativity mechanisms scored the highest on innovation performance. The group with low individual and high organizational creativity mechanisms has higher level of innovation performance than its comparable group. Lastly, the group with high individual and low organizational creativity mechanisms did not have higher level of innovation performance.
8. Marañón-Valencia et al. (2011)	To analyse the organizational culture that fosters or inhibits organizational innovation or imitation strategy.	471 CEOs from Spanish companies.	Survey based study with a hierarchical multiple regression analysis. Innovative or imitative orientation is measured as the perception of managers on the proactive character of innovations and the level of opportunity in responses from rivals. The culture of the organization is measured using an adapted version of the Organizational Culture Assessment Instrument, a survey that is completed by the managers of the organization.	Organizational culture can affect the innovation or imitation orientation of a firm positively or negatively. Autocracy cultures foster innovation orientation, while hierarchy culture fosters imitative orientation.
9. Bisbe & Dñey (2004)	The relation between interactive use of Simon's Management Control Systems (MCS) and product innovation.	Top management of 58 medium-sized Spanish manufacturing firms, with annual turnover between 18 and 180 million euro's and between 200 and 2,000 employees.	Survey based research used to measure the interactive use of top management of three control mechanisms, budget systems, balanced scorecards and project management systems. Product innovation is self-measured by management by rating four innovation dimensions of their company, which is compared to actual average industry performance.	Interactive use of MCS does not positively correlate with innovation. Division of sample shows no relation for low innovators and a negative relation for high innovators. No indirect effect of interactive use of MCS on performance acting through innovation, but there is a positive and significant moderating effect.

Figure 2 – Summary table of reviewed articles.

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## 4 Theoretical framework

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Presented in this chapter are the final framework and the hypotheses. The hypotheses are based on the research question of this research and are built upon the information gained from the overview and review chapter. Furthermore, the final framework is an adaptation of the preliminary framework presented at the end of the overview chapter.

### 4.1 Final framework

The final framework is based on the preliminary framework; however, the scope of the framework is reduced. Although incentives, strategy and management control systems are interesting and closely related to the research question, they are off-topic and do not help in answering the research question of this thesis.

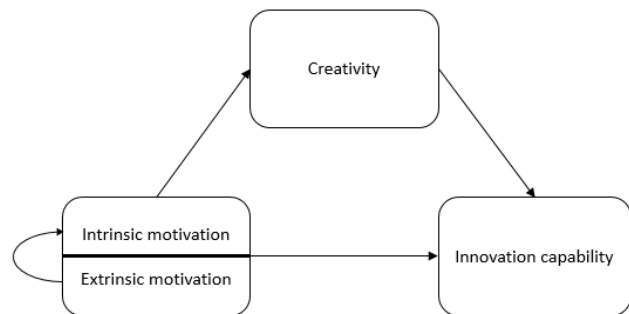


Figure 3 – Final framework

For that reason are incentives, strategy and management control systems removed from the final framework. Furthermore, the motivation aspect of the preliminary framework is divided and a clear distinction is made between intrinsic and extrinsic motivation, and the effect of extrinsic motivation on intrinsic motivation is added. This final framework is the basis for the hypotheses, which is discussed extensively in this chapter.

### 4.2 Intrinsic motivation – extrinsic motivation – creativity

According to Amabile (1997) everyone can be creative and can produce creative work. Woodman, Sawyer & Griffin (1993) and Amabile (1997) introduce models on creativity and determine that certain characteristics and conditions influence creativity. Although the models do not classify the same aspects that influence creativity, both authors value intrinsic motivation as the greatest determinant of creativity.

Amabile et al. (1994) states that intrinsic motivation is positively correlated with creativity and that extrinsic motivation is negatively correlated with creativity. According to this research, people who pursue a career that is 'hard', such as arts or sciences, are more intrinsically motivated and creative than people with other careers. The results of Ryan & Deci (2000b) indicate that intrinsically motivated individuals are more creative than extrinsically motivated individuals. Eisenberger & Aselage (2009) conduct a study on the effects of extrinsic motivators on intrinsic motivation. Although their

results indicate a positive relation between a reward for high performance and intrinsic motivation, the results also indicate a positive relation between intrinsic motivation and creativity.

Kachelmeier et al. (2008) perform experiments to determine the difference in productivity when performance-based compensation is based on quantity and/or creativity measures. Quantity incentives result in high quantitative performance, however, these incentives have a negative influence on creative performance. Creativity incentives result in high creative performance, but these incentives have a negative influence on quantitative performance. The results of Kachelmeier et al. (2008) suggest that the indicators which are measured and rewarded are the metrics that people try to pursue in their performance.

According to the crowding-out theory, intrinsic motivation decreases when extrinsic motivators are introduced (Frey & Jegen, 2001). Furthermore, due to the effect of extrinsic motivation on intrinsic motivation, extrinsic motivators can lead to diminished output (Bonner & Sprinkle, 2002). Amabile et al. (1994) state that the two types of motivation are two distinctive processes of individual motivation. According to the motivation-hygiene theory, extrinsic factors and intrinsic motivators are no opposites; an increase in one type of motivation does not result in a decrease in the other type of motivation. In addition, Cerasoli et al. (2014) state: "with respect to performance, incentives and intrinsic motivation are not necessarily antagonistic".

The results from the meta-analysis of Cameron & Pierce (1994) indicate that rewards do not negatively impact intrinsic motivation. In specific situations, verbal rewards increases intrinsic motivation (Cameron & Pierce, 1994). The results of the experiments of Eisenberger & Aselage (2009) show a positive relation between expected rewards for high performance and performance pressure, and performance pressure and intrinsic motivation. This indirect relation between expected rewards for high performance and intrinsic motivation is caused by reward expectancy for high performance that results in individuals experiencing pressure to do well (Eisenberger & Aselage, 2009). The results of the meta-analysis study of Deci, Ryan, & Knoester (1999) indicate that tangible rewards have a negative effect on intrinsic motivation. According to the authors, this relation is caused because extrinsic motivators undermine the responsibility of individuals for motivating and regulating themselves.

Gagné & Deci (2005) state that "it is well established that use of salient extrinsic rewards to motivate work behaviour can be deleterious to intrinsic motivation." According to Wiersma (1992) extrinsic motivators reduce intrinsic motivation if they are perceived as controlling. This is because the introduction of extrinsic motivators is usually accompanied with extra surveillance and evaluation, which reduce the autonomy of individuals (Deci et al., 1999). According to Gagné & Deci (2005) extrinsic motivators undermine intrinsic motivation because it changes the perceived locus of

causality. As stated before autonomy, combined with competence and relatedness is the basis of intrinsic motivation (Deci & Ryan, 2008).

Intrinsic motivation positively influences creativity, and extrinsic motivation negatively influences creativity. The literature does not agree on the relation between intrinsic and extrinsic motivation. However, the two types of motivation are no antagonists, which is important to note. Because the assumption that intrinsic and extrinsic motivation are opposites indicates balance between the two types of motivation, in which an action in one type of motivation leads to a reaction in the other type of motivation.

In this thesis, and based on the presented literature, it is assumed that extrinsic motivation negatively affects creativity through its effect on creativity. In addition, intrinsic and extrinsic motivation are two distinct types of motivation. Therefore, the first hypothesis is a mediation relation between extrinsic motivation and creativity through intrinsic motivation.

*H1: Extrinsic motivation negatively affects creativity through its effect on intrinsic motivation.*

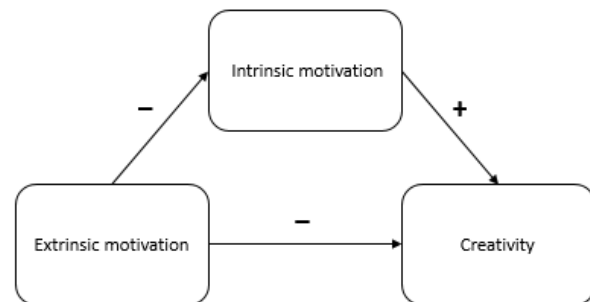


Figure 4 – Hypothesis 1

#### 4.3 Motivation – creativity – innovation capability

Hammond et al. (2011) perform a meta-analysis study on, among others, the effect of motivation on individual level-innovation. The results show a positive relation between intrinsic motivation and innovation. In addition, the relation between extrinsic motivation and innovation is also positive, but this relation is weaker than the relation between intrinsic motivation and innovation is.

Cerasoli et al. (2014) perform a meta-analysis study on the use of intrinsic or extrinsic motivation as indicators for performance. The results of this research indicate that intrinsic motivation is the best indicator for quality dependent performance, whereas extrinsic motivators are the best indicator for quantity dependent performance. According to the authors, extrinsic motivators should be linked to straightforward tasks. In such a task, the output is dependent on the simplicity of the task and the commitment of employees. “Tasks that require a great deal of absorption, personal investment, complexity, and overall quality should be less linked to incentives and much more closely linked to intrinsic motivation” (Cerasoli et al., 2014). Since innovation in companies is complicated and

quality dependent, it is assumed that intrinsic motivation is positively related to innovation and that extrinsic motivation is negatively related to innovation.

Lawson & Samson (2001) describe creativity as one of the seven important elements for the innovation capability of an organization. Amabile (1988, 1997) presents the componential theory of creativity, in which individual and organizational components have to be present in order for individuals to be creative and companies to be innovative. Under the right circumstances, when these components are present, creativity and innovation can arise. According to Janssen (2000) and De Jong & Den Hartog (2007b) creativity is crucial for organizational success. As McLean (2005) puts it, the relation between creativity and innovation is not surprising. Creativity is the process of individuals generating new ideas, whereas innovation is the process of companies capturing these ideas and transforming them into marketable products or services. Creativity is the first step in the innovation process because it provides input and is a major source for innovation (Amabile, 1997; Lawson & Samson, 2001). Creativity is a crucial component in the innovation process of an organization.

In this thesis, it is assumed that performing a task because it is interesting and satisfying in itself is a better motivator than performing a task for a positive or a negative consequence. Intrinsic motivation is positively related to quality related performance and extrinsic motivation is negatively related to quality related performance. Innovation is the result of quality related performance and not of quantity related performance. Because creativity is a major supplier of the organizational innovation process, creativity strengthens the positive relation between intrinsic motivation and innovation capability and weakens the negative relation between extrinsic motivation and innovation capability. Therefore, the second hypothesis is a moderation relation between intrinsic and extrinsic motivation and organizational innovation capability, and the effect of creativity on this relation.

*H2a: Creativity increases the positive effect of intrinsic motivation on the organizational innovation capability.*

*H2b: Creativity decreases the negative effect of extrinsic motivation on the organizational innovation capability.*

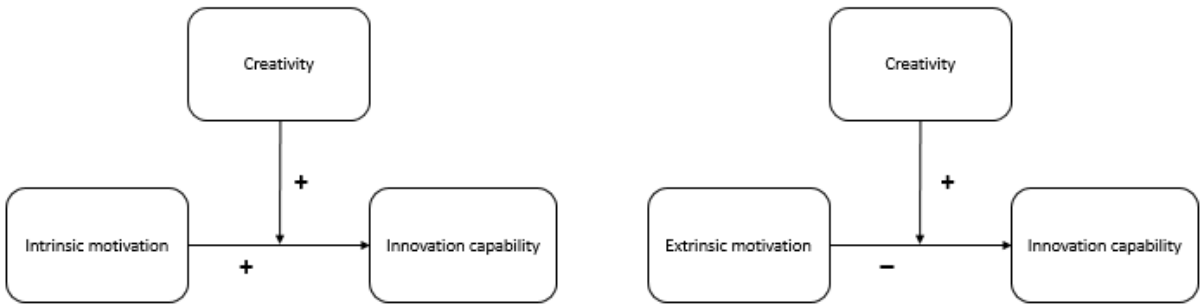


Figure 5 – Hypothesis 2a and hypothesis 2b

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## 5 Research method

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The research method of this research is based on the scientific method. First, a real life phenomenon is observed and a research question is derived based on this phenomenon. Second, information is gathered and a theoretical framework is proposed, which is a model that attempts to explain the occurrence of this phenomenon. Third, the hypotheses derived from literature predict a relation, and this relation is tested. Fourth, the results from the tests are analysed and confirm or reject the hypotheses.

In this chapter, it is presented which steps are taken to test the hypotheses and analyse the results. Explained is what the research design is, established what the population and sample are and how the data is obtained. In addition, it is explained how the variables are operationalized and the regression model for the hypothesis is presented.

### 5.1 Research design

The design of this research is correlational, non-experimental and cross-sectional. Cross-sectional research designs gather data from a representative sample of the total population, at one distinct point in time. Respondents complete the questionnaire once, because it is assumed that the variables and the relation between the variables will not differ over time.

A drawback of cross-sectional research design is that secondary data is usually not suitable; therefore, primary data needs to be collected. However, an advantage of this research design is that primary data is relatively easy to collect. Questionnaires are an often-used method to collect data for cross-sectional research, since they are an inexpensive and an easy to administer data collection method.

The data is collected by using SurveyMonkey. The respondents receive the questionnaire by email; this method allows them to respond anonymously, at the time that suits them and in their own pace. Furthermore, this method of data collection fosters quick processing and high accuracy compared to questionnaires on paper. However, since there is no direct incentive, or even pressure, to complete the questionnaire, people who receive the invitation to complete the questionnaire could easily choose not to do so. Which can result in low response rates and results that are not generalizable. In addition, creating a questionnaire that produces consistent and interpretable results is a complicated process. Although, the questionnaire is derived from previous research, a pilot study was conducted to ensure its understandability.



## **Population**

The high-tech industry is not an industry that is strictly defined. Dutch Chamber of Commerce uses SBI-codes to categorize companies in The Netherlands. According to a rapport of the Statistics Netherlands (CBS) a distinction is made between the low-, medium- and high-tech industries in the Netherlands, based on “the occasional paper no. 30 of the European Central Bank”, and these industries are indicated with SBI-codes (“Verdeling industrie naar low-, medium -en high-tech sector.,” 2005). Standaard Bedrijfsindeling or SBI is a classification of main activity of companies.

According to the rapport of the CBS, companies with the SBI-codes 30, 31, 32 & 33 are operating in the Dutch high-tech sector. The 30, 31, 32 & 33 SBI-codes represent industries in which companies produce and repair office equipment and computers, medical equipment companies and audio-, video- and telecommunication-equipment. Weterings et al. (2007) define the high-tech industry as the companies with the 30, 31, 32 & 33 SBI-codes, but they exclude companies that perform reparations and they include specialized research and development facilities. The population for this research are the companies with the 30, 31, 32 & 33 SBI-codes, based on the 1993 SBI classification.

## **Sample**

The companies in the sample are selected with an online tool of the Dutch Chamber of Commerce website. Similar to Weterings et al. (2007) the reparation companies are excluded from the sample and the installation companies are also excluded. In addition, the specialized research and development facilities and three industries with the SBI-codes 32501, 32502(1) and 32502(9) are excluded. The specialized research and development facilities are operating in the high-tech industry, but unlike others companies the purpose of existence for specialized research and development facilities is to develop new products and services. For companies in the other industries, the development of new products and services is a process that enables them to continue to conduct their business in the future. Research and development is important and even crucial for these companies, but it is not their main purpose. In addition, their innovation capability is not comparable to that of the rest of the sample.

The 32501 industry (tandtechnische bedrijven) is not included in the sample because the 545 companies in this industry are too many compared to the total number of companies included in the sample. Moreover, the companies in this industry produce medical products and do not fit in the scope of this thesis, therefore they are not included in the sample. The 32502(1) and 32502(9) industries are not included because the Chamber of Commerce tool to select companies in specific industries combine all the companies from the 32502\* industry. The 32502\* industry consists of 59 sub-industries and 376 companies. It is not possible to extract only the companies in the 32502(1) and 32502(9)

industry and the 32502\* industry is too big to add to the sample without diminishing the quality of the sample by including low and medium tech companies.

Furthermore, headquarters of the companies and only entities that are economically active are selected via the Chamber of Commerce selection tool. The following legal entities are included in the sample: 'besloten vennootschap', 'eenmanszaak met meer dan één eigenaar', 'naamloze vennootschap' and 'vennootschap onder firma'. In addition, the minimum number of employees of companies in the sample is greater than one. These criteria result in a sample of 707 companies operating in the high-tech sector in the Netherlands. The SBI-codes of the sample are presented in appendix A.

The companies in the sample are contacted to participate in this research and to complete the questionnaire. The total number of companies in the sample is small enough to contact by email. Furthermore, the individuals that are responsible for the day-to-day operation are the unit of analysis. They are capable of evaluating the innovation capability of the company, and their motivation and creativity affects the innovation capability of the company.

The Sobel test is used to test the significance of the mediation effect in the first hypothesis, and with a sample of less than 25 observations this test cannot be used (Preacher & Leonardelli, 2003). Although it is not comparable to this research, Dulaimi, Ling, & Bajracharya (2003) have a response rate of 5.91%. The authors contacted their respondents 'cold' as there was no previous contact between the authors and the respondents. The same holds for Saunila et al., (2014) with a response rate of 7,68%. The sample is also contacted without any previous contact, which can affect the response rate of the questionnaire used in this research.

## **5.2 Variables**

The dependent, independent and control variables used in the regression model are described below. In addition, the operationalization of the variables is explained and the Libby boxes are presented.

### **Dependent variable**

#### *Innovation capability*

Coad & Rao (2008) use two indicators to determine firm innovation; firm applied patents and the R&D spending. However, there are drawbacks of using firm applied patents and R&D spending as a measurement of innovation; not all innovations are patented and not all patents leads to innovations. The patent application process is expensive and time consuming and not all companies can afford this. In addition, R&D spending as a measure may underestimate innovation because not all innovation is performed in the R&D department. Because of the large number of relative small companies in the

sample of this thesis, this is not a good measurement of innovation capability. Compared to large companies, smaller companies are less likely to bear the costs associated with the patent application process.

Some other authors use self-rated measures of organizational innovation or innovation capability. Thornhill (2006) uses a simple measure for innovation by using a binary variable in a questionnaire: whether the company introduced a national or world-first new product in 1999. Lau & Ngo (2004) also use a self-rated measure for product innovation and it compares the performance of developing new products and services in the past, compared to the competitors of the company.

Another way of measuring the innovation capability of companies is used by Tamer Cavusgil, Calantone & Zhao (2003) and is based on the work of Subramaniam & Venkatraman (2001). The items used to measure innovation capability are based on the dimensions of “frequency of innovations, order of market entry, simultaneous entry in multiple markets and the ability to penetrate new markets” (Tamer Cavusgil et al., 2003). Subramaniam & Venkatraman (2001) add the ability of companies to be competitive in terms of price. However, these measurements provide a representation of the innovation capability of companies introducing new products in new markets.

Lin (2007) uses a short self-rated measurement tool for firm innovativeness which is based on Calantone (2002). The data on firm innovativeness was obtained from R&D vice presidents from large U.S. companies from different industries. This innovativeness measurement tool has been tested and validated (Calantone et al., 2002). This measurement tool uses a six point Likert scale, varying from (1) ‘strongly disagree’ to (6) ‘strongly agree’. The measure of innovativeness is a proxy for the organizational innovation capability. The questionnaire is included in appendix B.

## **Independent variables**

### *Motivation*

Ryan & Deci (2000a) state that an experiment can be conducted to determine the degree of motivation of people for a certain activity. In this experiment, participants have to perform a task and either receive or do not receiving a reward. After a certain time, the participants are told that that they do not have to work on the task any further. The participants can continue on the principal task or start with other activities. The intrinsic motivation of participants is expected to be higher when there is no extrinsic motivator for participating the experiment. However, for this thesis, conducting an experiment is not realistic. Because it is very difficult to get people that are representable for the population to participate in this experiment.

Gagné & Deci (2005) introduce a measurement tool which determines the motivation of an individual and is based on the self-determination theory. This intrinsic motivation inventory determines the subjective experience of individuals related to activities. The interest/enjoyment

subscale consists of seven questions related to the interest and enjoyment of an activity. Although the measurement is widely used and validated, it is mostly used in experiments. The participants complete the questionnaire after an experiment and the results indicate the motivation of the individual on the task of the experiment.

Tremblay et al., (2009) introduce an 18-item measure of work motivation based on self-determination theory. The employee motivation that results from this questionnaire is intrinsic motivation, four types of extrinsic motivation and amotivation. This questionnaire is developed to measure the motivation of employees for their jobs instead of focusing on the motivation of participants after completing a task in an experiment. Summing the means of the self-determined subscales intrinsic motivation, integrated regulation and identified regulation creates the work self-determination motivation (W-SDM) score. Summing the means of introjected regulation, external regulation and amotivation creates the work nonself-determination motivation (W-NSDM) score. The W-SDM and W-NSDM scores are a proxy for respectively intrinsic and extrinsic motivation.

This measurement tool uses a five point Likert scale; varying from (1) 'does not correspond at all' to (5) 'corresponds exactly'. The work self-determination index is included in appendix C.

### *Creativity*

The most common measurement approaches of creativity are self-rated measurement approach and others rating measurement approach. The objective rating can also be used but only in specific situations in which the output of an individual is a valid proxy for their creativity. The objective rating can be used for artists, measuring their output and thus focusing on the product facet of creativity. The research of Silvia (2008) indicates that people are able to identify their creative ideas. In addition, the results indicate the most creative individuals are the best at identifying their creative ideas. An objective rating would be a good measurement approach for creativity, but due to constraints is this not attainable. Therefore, the self-rated measurement approach is adequate.

The innovative work behaviour designed by de Jong & den Hartog (2010) is a measurement tool to measure the innovative output of individuals. This tool includes the generation of creative ideas and the championing and implantation of these ideas. However, the tool emphasizes the implementation and output of innovative behaviour and focuses too little on the generation of creative ideas.

The creative achievement questionnaire introduced by Carson, Peterson & Higgins (2005) is a tool that measures the personal side of creativity in fields such as arts and sciences. Furthermore, this questionnaire focuses on the achievements in these creative fields. The questionnaire is short and easy to administer and it has good internal validity. However, this measurement tool focuses on creative achievement and this skews the creative scores because people who are creative, but have not

engaged in creative activities and have no creative achievements have the same creativity score as people who are not creative at all.

The creative behaviour inventory of Dollinger (2003) is a tool that measures creative achievement and creative behaviour. Because this measurement tool distinguishes between the creativity of individuals and achievement in creative fields it is a good measurement tool for creativity. This tool values both little-c and Big-C, as it measures at everyday creative output and creative achievements. Dollinger (2003) created a short version of the CBI which according to Silvia et al. (2012) is a good measure of creativity, and a better version than the original of Hovecar. The questionnaire allows respondents to indicate the answer that describes the frequency of their behaviour in adolescent and adult life. This measurement tool uses a four point scale, (1) 'never did this', (2) 'did this once or twice', (3) 'did it 3-5 times' and (4) 'did it more than 5 times'. The CBI questionnaire is included in appendix D.

### **5.3 Control variables**

Multiple control variables are used in the regression analysis of this thesis. The control variables are on both individual and organizational unit of analysis to control for organizational and social-demographic differences. The control variables are obtained from the individuals completing the questionnaire.

First control variable is gender of respondents measured as 0 'female' and 1 'male' and is labelled Gender. Although, it is not expected that gender of respondents influence the motivation and creativity of individuals, it is a useful variable for demographic information of the respondents.

Second control variable is age of respondent and is measured as the year in which they were born and is labelled as Respondent age.

Third control variable is tenure, is measured as the year in which they started working for their employer and is labelled as Tenure. The research of Amabile et al. (1994) indicates that the intrinsic motivation of individuals decreases over time.

Fourth control variable is the highest held education of respondents and is labelled Education. Education is measured as (1) equal to or below high school degree, (2) bachelor degree, (3) master degree and (4) equal to or above PhD degree.

Fifth control variable is firm size, which is measured using the number of FTE in the firm and is labelled Firm size. The size of a company can influence its innovativeness, as larger have more resources and benefit from economies of scale. Large firms are more rigid and bureaucratic than smaller firms. The variable is measured as the total number of FTE: (1) 2 to 4, (2) 5 to 9, (3) 10 to 19, (4) 20 to 49, (5) 50 to 99, (6) 100 to 199, (7) 200 to 499, (8) 500 to 999 and (9) 1.000+. This is the classification of firm size used by the Dutch Chamber of Commerce.

Sixth control variable is company age and is measured as the year in which the company was founded and is labelled Company Age. Older companies have an advantage over younger companies, because older companies have more relations and access to more information (Calantone et al., 2002).

Seventh control variable is the position of respondents, is measured as 0 'managerial position' and 1 'non-managerial position' and is labelled Position.

#### **5.4 Statistical analysis**

Two statistical methods are used to test the hypothesis of this research: factor and regression analysis. These methods are discussed in the following paragraphs.

##### **Factor analysis**

Factor analysis is performed identify indistinct factors and group correlating variables based on underlying dimensions. Factor analysis may reduce the total number of variables by grouping them and it increases the interpretation of variables through the introduction of factors.

##### **Regression analysis**

A regression analysis is performed to quantify the relation between the dependent and independent variables. The results of a regression analysis displays the change of the dependent variable when one of the independent variable changes. Multiple assumptions have to be satisfied to be able to perform a solid regression analysis.

#### **5.5 Regression model**

Presented here are the regression models used in this research. For the first hypothesis the mediated multiple regression test and the Sobel test are used and for the second hypotheses a moderated multiple regression test is used. Both hypothesis are supplemented with Libby-boxes to present the conceptual and operational constructs of the hypotheses.

### Hypothesis 1

The first hypothesis is: 'Extrinsic motivation negatively affects creativity through its effect on intrinsic motivation' and includes a mediating variable, for which a specific regression model is needed to test the hypothesis. In a mediation model, the relation between the dependent and independent variables is indirect and is influenced by a third variable: the mediator or 'M' in figure 6.

Four relations have to be tested in this simple mediation model (Preacher & Hayes, 2008). These four relations are displayed in figure 6, which is obtained from Preacher and Hayes (2008). Equation I shows that the total effect (c) in the mediation model is the combination of the direct effect (c') and the indirect effect (ab).

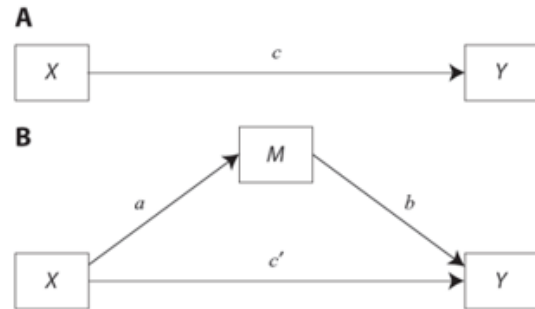


Figure 6 – (A) Illustration of a direct effect. X affects Y. (B) Illustration of a mediation design. X is hypothesized to exert an indirect effect on Y through M. (Preacher & Hayes, 2008)

$$c = c' + ab \quad (I)$$

The four relations from figure 6 are converted in three regression models: because path a and path c' from can be tested in the same regression model. The general model for the four relations are introduced and translated into equations. In addition the Sobel test and bootstrapping method are conducted to determine if there is a meditation effect in hypothesis one.

The variables used in the regression models are: INNOVATION is innovativeness, CREATIVITY is employee creativity, INTRINSIC is intrinsic motivation, EXTRINSIC is extrinsic motivation, GENDER is gender of respondents, POSITION is position of respondents, RESPONAGE is age of respondents, TENURE is tenure of respondents, EDUCATION is highest held education, FIRMSIZE is firm size, FIRMAGE is company age and  $\varepsilon$  is error term. In the next part creativity is the dependent variable Y, intrinsic motivation is the independent variable X and extrinsic motivation is the mediating variable M.

The first step in the mediation model is to establish a direct and significant relation between the dependent and independent variable. Equation II is the model in which Y is the dependent variable and X the independent variable, and is based on path c from figure 6A. In a simple mediation model control variables or covariates can be added, but only if they are added in all the equations of the simple mediation model (Preacher & Hayes, 2008).

$$Y_i = \beta^0_i + \beta^1 X_i + \varepsilon_i \quad (II)$$

Which translates to the following regression model of path c.

$$\begin{aligned}
CREATIVITY_i = & \beta^0_i + \beta^1EXTRINSIC_i + \beta^2GENDER_i + \beta^3POSITION_i \\
& + \beta^4RESPONAGE_i + \beta^5TENURE_i + \beta^6EDUCATION_i \\
& + \beta^7FIRMSIZE_i + \beta^8FIRMAGE_i + \varepsilon_i
\end{aligned} \tag{III}$$

The second step in the mediation model is to establish a significant relation between the mediating variable and the dependent variable. Equation IV is the model in which M is the dependent variable and Y is the independent variable and is based on path a from figure 6B.

$$M_i = \beta^0_i + \beta^1Y_i + \varepsilon_i \tag{IV}$$

Which translates to the following regression model of path a.

$$\begin{aligned}
INTRINSIC_i = & \beta^0_i + \beta^1CREATIVITY_i + \beta^2GENDER_i + \beta^3POSITION_i \\
& + \beta^4RESPONAGE_i + \beta^5TENURE_i + \beta^6EDUCATION_i \\
& + \beta^7FIRMSIZE_i + \beta^8FIRMAGE_i + \varepsilon_i
\end{aligned} \tag{V}$$

The third step is to establish a significant relation between the dependent variable and the mediating variable, including all independent variables, to show that the mediating variable affects the dependent variable. Equation VI is the regression model in which Y is the dependent variable, X is the first independent variable and M is the second independent variable and the mediating variable. Equation VI is based on path b from figure 6B.

$$Y_i = \beta^0_i + \beta^1X_i + \beta^2M_i + \varepsilon_i \tag{VI}$$

Which translates to the following regression model of path b.

$$\begin{aligned}
CREATIVITY_i = & \beta^0_i + \beta^1EXTRINSIC_i + \beta^2INTRINSIC_i + \beta^3GENDER_i \\
& + \beta^4POSITION_i + \beta^5RESPONAGE_i + \beta^6TENURE_i \\
& + \beta^7EDUCATION_i + \beta^8FIRMSIZE_i + \beta^9FIRMAGE_i + \varepsilon_i
\end{aligned} \tag{VII}$$

The fourth step is to establish that the mediating variable mediates the relation between the dependent and independent variable. This is path c' from figure 6B and is shown in model VIII.

According to Preacher & Hayes (2004), "the Sobel Goodman test is conducted by comparing the strength of the indirect effect of X on Y to the point null hypothesis that it equals zero." Equation I



can be rewritten into the equation in which the indirect effect (ab) is the result of the total effect (c) minus the direct effect (c').

$$ab = c - c' \quad \text{(VIII)}$$

The Sobel is performed to test the significance of the mediation effect. It tests whether there is a significant reduction in the effect of the independent variable after the mediating variable is included. In addition to the Sobel test, the bootstrapping method of Preacher & Hayes (2004) is used to test the significance of the mediation effect. The Libby Box of hypothesis one is presented in appendix E.

### Hypothesis 2

The second hypotheses is '*Creativity increases (decreases) the effect of intrinsic (extrinsic) motivation on the organizational innovation capability*'. The second hypotheses incorporate a moderating variable in which creativity affects the strength of the relation between motivation and innovation.

In the next part innovativeness is the dependent variable Y, intrinsic (extrinsic) motivation is the independent variable X and creativity is the moderating variable M. Control variables or covariates can be simply added to this moderated regression model (Hayes, 2009).

Equation IX is the moderated multiple regression model in which Y is explained by X, M and a combination of XM.

$$Y_i = \beta^0_i + \beta^1 X_i + \beta^2 M_i + \beta^3 X * M_i + \varepsilon_i \quad \text{(IX)}$$

This translates to the following equations for hypothesis 2a and hypothesis 2b.

$$\begin{aligned} \text{H2A: } INNOVATION_i &= \beta^0_i + \beta^1 INTRINSIC_i + \beta^2 CREATIVITY_i \\ &+ \beta^3 INTRINSIC * CREATIVITY_i + \beta^4 GENDER_i \\ &+ \beta^5 POSITION_i + \beta^6 RESPONAGE_i + \beta^7 TENURE_i \\ &+ \beta^8 EDUCATION_i + \beta^9 FIRMSIZE_i + \beta^{10} FIRMAGE_i + \varepsilon_i \end{aligned} \quad \text{(X)}$$

$$\begin{aligned} \text{H2B: } INNOVATION_i &= \beta^0_i + \beta^1 EXTRINSIC_i + \beta^2 CREATIVITY_i \\ &+ \beta^3 EXTRINSIC * CREATIVITY_i + \beta^4 GENDER_i \\ &+ \beta^5 POSITION_i + \beta^6 RESPONAGE_i + \beta^7 TENURE_i \\ &+ \beta^8 EDUCATION_i + \beta^9 FIRMSIZE_i + \beta^{10} FIRMAGE_i + \varepsilon_i \end{aligned} \quad \text{(XI)}$$

The Libby Box of hypotheses two is in appendix E.

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## 6 Results

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In this chapter, the hypotheses are tested in an attempt to answer how intrinsic and extrinsic motivation and creativity affect the innovation capability of high-tech companies. In this chapter is explained how the data is collected and how many companies are contacted to complete the questionnaire. The final sample of this research is presented and the sample is tested for differences compared to the population. A factor analysis is performed to determine if the measurement tools measured what they were supposed to measure. The factor analysis identifies underlying dimensions, but multiple assumptions have to be satisfied to be able to perform a factor analysis.

Before performing the regression analyses additional assumptions have to be satisfied. After satisfying these assumptions, the regression analyses are performed. The first regression analysis is the mediation model, in which multiple relationships have to be tested in order for the model to be validated. In addition, the Sobel test and bootstrapping method are performed to provide extra evidence for this mediation relation. The second regression analysis is a multiple regression analyses with an added moderated variable and is based on the second hypotheses. The assumptions for regression are also discussed for this model.

### 6.1 Data collection

An English and a Dutch version of the questionnaire are created and sent via email by SurveyMonkey, a self-administering web based survey tool. The gathered data was exported to Excel and imported in SPSS.

A pilot study was conducted to test for understandability of the questionnaire. The test group included students, and employees working in the high-tech industry in managerial and non-managerial positions. The respondents were asked to complete the questionnaire. Even though, the questionnaire is based on existing measurement tools, changes were suggested to improve the understandability of the questionnaire.

Feedback included comments on the repeatability of the questions in the measurement tools of creativity and motivation. The repeatability of questions could not be addressed, as they are validated measurement tools. The questioning in the measurement tools was adapted, because they were unclear. One respondent working at a high-tech firm suggested presenting a Dutch version along with an English version of the questionnaire. Because not all email recipients are able or are willing to complete a questionnaire in English. The Dutch and English version of the questionnaire was compared sentence for sentence to ensure that the questionnaire and gathered data is similar. In this process, grammatical errors were spotted and corrected.

The datasheet from the Chamber of Commerce on the Dutch high-tech companies contains detailed contact information. Nevertheless, this datasheet did not include the website or email address of the selected companies. After the initial selection process, 887 high-tech companies were eligible to be included in this research. The email addresses from these companies were taken from the contact page of their website. Not all email addresses could be traced. Some companies did not have a website, and other companies were not anymore in business. In addition, larger companies did not have a public email address displayed on their website. Some companies have multiple email addresses on their website, therefore 707 emails were sent to 655 companies. Of the 707 emails, 682 arrived. Twenty-five emails bounced because the email address did not exist or for other technological reasons. The email to participate in this research was sent in both Dutch and English, with a link to the Dutch and English questionnaire. Two reminders were sent to the respondents, two weeks and four weeks after the initial invitation. As a result, 105 respondents completed the questionnaire, which is a response rate of 15.40%. Almost all respondents completed the Dutch version of the questionnaire; three people completed the English version.

## 6.2 Final sample

In this subchapter, the final sample is introduced and multiple tests are performed to determine if the sample is an accurate representation of the population.

Some of the data obtained from the questionnaire has been transformed: the fifth question on the measurement tool on innovativeness is negatively worded and therefore the results of this question are reversed. In addition, the data concerning year of birth, starting year at their employer and company age are also converted.

Table 1 – Key figures of respondents

<i>Key figures of sample</i>					<i>Firm size of population and sample</i>					
<i>Education of level</i>	<i>Age in years</i>		<i>Company age in years</i>		<i>Category</i>	<i>Population</i>		<i>Sample</i>		
						<i># of firms</i>	<i>Percentage</i>	<i># of firms</i>	<i>Percentage</i>	
Equal to or below high school degree	24	21 - 30	11	0 - 5	8					
Bachelor degree	39	31 - 40	13	6 - 10	6	2 t/m 4	331	37.3%	28	31.8%
Master degree	23	41 - 50	27	11 - 15	16	5 t/m 9	165	18.6%	16	18.2%
Equal to or above PhD degree	2	51 - 60	33	16 - 20	12	10 t/m 19	143	16.1%	10	11.4%
		61 - 65	4	21 - 25	12	20 t/m 49	134	15.1%	15	17.0%
<i>Position</i>				26 - 30	8	50 t/m 99	52	5.9%	12	13.6%
Managerial	54	<i>Tenure in years</i>		31 - 35	10	100 t/m 199	33	3.7%	3	3.4%
Non-managerial	34	0 - 5	26	36 - 40	5	200 t/m 499	20	2.3%	4	4.5%
		6 - 10	22	41 - 45	4	500 t/m 749	2	0.2%	0	0.0%
<i>Gender</i>		11 - 15	8	46 - 50	2	750 t/m 1.000	2	0.2%	0	0.0%
Female	15	16 - 20	15	51 >	5	1.000+	5	0.6%	0	0.0%
Male	73	21 >	17			Total	887	100%	88	100%

Of all the respondents, 92 completed the questionnaire, a completion rate of 88.62%. Thirteen respondents were deleted from the sample because they did not complete the questionnaire. The results from the questionnaire were examined to ensure the quality of the data. Of the 92 responses, two respondents responded twice. This was noticed because results of the responses were completely

similar, and they were completed four weeks apart. In addition, there were two cases of two responses from the same company. The latest entries were deleted.

This leaves 88 useable responses. Table 1 shows key figures on the composition of the sample. In the sample, 73 respondents are male, and 54 respondents are in a managerial position. Only two respondents have a PhD degree, 24 respondents have an equal or below high school degree and the majority have either a bachelor (39) or a master (23) degree. All respondents are older than 20 and younger than 65, which is the retirement age in Holland. Almost half of the respondents have been working for less than 10 years and 17 respondents have been working longer than 21 years for their current employer. In addition, there is a table on the composition of the population and sample in terms of firm size. No firms represented in the sample have more than 500 employees, whereas nine in the population have over 500 employees; seven firms in the sample have over 100 employees. Besides these missing 'big' companies, the sample appears to be representative of the population.

### **6.3 Sample testing**

Multiple tests are performed to ensure that the sample represents the population and to ensure that there are no major differences with the population. An independent t-test is performed to test the differences between the means and standard deviations of certain variables of the two groups. The paragraphs on the tests are accompanied with tables of the output of the independent t-test. The group statistics are presented in this table, which shows the number of cases, and the means and standard deviations of the test variables. Levene's test for equality of variance validates the assumption of homogeneity of variances. The t-test for equality of means shows any difference between the means of the tested groups, assuming equal or not equal variances. If the p-value or 'sig.' is below or equal to 0.05 there is statistical difference between the variances and the means of the two tested groups.

#### **Sampling bias test**

To test whether the sample is representative of the population an independent t-test is performed. There is little information available on the firms in the population and in the sample, except the size and age of these firms. Because there is no information on the employees of the firms in the population no tests can be performed to test for differences between the respondents, which are employees from firms in the sample and employees from firms in the population. An independent t-test was performed to establish whether the sample and population were statistically different in firm size and firm age. As can be seen in the group statistics of table 2, the sample consists of 88 companies, and the population consists of 887 companies. Furthermore, the mean and standard deviation of firm size and firm age appear to be unequal.

The assumptions of homogeneity of variance was tested and satisfied via Levene's *F* test for the variable; firm size  $F(973) = 1.29, p = .257$  and firm age  $F(973) = 2.89, p = .089$ . The independent *t*-test was not statistically significant for the variable; firm size  $t(973) = 1.58, p = .115$  and firm age  $t(973) = .18, p = .860$ . Thus, the mean of the firm size and firm age of the sample are equal to that of the population.

Table 2 – Group statistics and independent *t*-test: Population vs. sample

Variables	Case	Group Statistics			Levene's Test for Equality of Variances		t-test for Equality of Means			
		N	Mean	Std. Dev.	Assumptions	F	Sig.	t	df	Sig. (2-tailed)
Firm size	Sample	88	2.91	1.798	Equal variances assumed	1.287	.257	1.576	973	.115
	Population	887	2.60	1.737	Equal variances not assumed			1.533	103.777	.128
Firm age	Sample	88	23.5455	14.39421	Equal variances assumed	2.892	.089	.176	973	.860
	Population	887	23.1793	18.97469	Equal variances not assumed			.220	119.235	.826

### Role of respondent bias test

To test whether the managers and non-managers differ in age, education and tenure, an independent *t*-test is performed. In addition, the independent *t*-test is also performed in regards to firm size and firm age to establish any differences between the companies of which managers or non-managers responded.

As can be seen in the group statistics of table 3, the managerial group consists of 54 respondents, and the non-managerial group consists of 34. Furthermore, the mean and standard deviation of the birth year, education and starting year of the respondents appear to be unequal, and the firm size and firm age appear to be unequal.

The assumptions of homogeneity of variance was tested and satisfied via Levene's *F* test for the variable; age  $F(86) = 2.89, p = .093$ , tenure  $F(86) = 1.60, p = .209$ , firm size  $F(86) = 1.05, p = .309$  and firm age  $F(86) = 0.00, p = .948$ . The assumption of homogeneity of variance was tested and not satisfied for the variable education  $F(82) = 4.54, p = .036$ , thus for the *t*-test for the quality of mean equal variances are not assumed.

Table 3 – Group statistics and independent *t*-test: Managerial vs. non-managerial

Variables	Position	Group Statistics			Levene's Test for Equality of Variances		t-test for Equality of Means			
		N	Mean	Std. Dev.	Assumptions	F	Sig.	t	df	Sig. (2-tailed)
Age	Managerial	54	47.80	9.614	Equal variances assumed	2.885	.093	2.668	86	.009
	Non-managerial	34	41.88	10.898	Equal variances not assumed			2.592	63.734	.012
Education	Managerial	54	2.07	.866	Equal variances assumed	4.536	.036	.593	86	.555
	Non-managerial	34	1.97	.674	Equal variances not assumed			.627	82.061	.532
Tenure	Managerial	54	12.87	9.264	Equal variances assumed	1.603	.209	1.161	86	.249
	Non-managerial	34	10.62	8.180	Equal variances not assumed			1.194	76.681	.236
Firm size	Managerial	54	2.63	1.674	Equal variances assumed	1.045	.309	-1.863	86	.066
	Non-managerial	34	3.35	1.921	Equal variances not assumed			-1.806	63.131	.076
Firm age	Managerial	54	24.1296	14.61590	Equal variances assumed	.004	.948	.478	86	.634
	Non-managerial	34	22.6176	14.20204	Equal variances not assumed			.481	71.806	.632

The independent *t*-test was not statistically significant for the variables: education  $t(82) = .627$ ,  $p = .532$ , tenure  $t(86) = 1.16$ ,  $p = .249$ , firm size  $t(86) = -1.863$ ,  $p = .066$  and firm age  $t(86) = .478$ ,  $p = .634$ . The independent *t*-test was statistically significant for the variable age  $t(86) = 2.67$ ,  $p = .009$ . Thus, the mean of the variables education, tenure, firm size and firm age of the managerial group are equal to that of the non-managerial group. Furthermore, the mean of the variable age of the managerial group is not equal to that of the non-managerial group.

#### **6.4 Factor analysis**

Factor analysis is a statistical procedure that can be used to interpret self-reporting questionnaires. According to Williams, Brown, & Onsmann (2012) this procedure reduces the number of items on a questionnaire by detecting “underlying dimension between measured variables and latent constructs” (Williams et al., 2012). There are multiple types of factor analyses, but in this research, the principal component is the best fit, as there are a number of factors expected based on the theory of the used measurement tools.

In the factor analysis, the motivation items with the name ‘Intrinsic’ measure intrinsic motivation and ‘Extrinsic’ measure extrinsic motivation. The 1, 2 or 3 that follows ‘Intrinsic’ or ‘Extrinsic’ indicates the subscale of the measurement tool. In addition, the number after ‘M’ indicates the question number on the motivation questionnaire. The 28-items of the creativity questionnaire are numbered, as well as the six-items of the innovativeness questionnaire.

To perform a factor analysis a number of conditions have to be satisfied. These conditions will be discussed in the following paragraphs.

##### **Variable measurement**

In order to be able to perform a factor analysis data should be measured at an interval level (Field, 2009). The questions used in the measurement tools of this research are Likert items and scores on Likert items are ordinal data. To clarify, an individual question on a questionnaire is a Likert item and the sum or mean of multiple Likert items is a Likert scale. Likert scale data is ordinal but can be assumed interval data.

##### **Sample size**

According to Williams et al., (2012) sample size is important for factor analysis, but the literature does not agree on an acceptable minimum number of cases. Williams et al., (2012) cite sources stating that the minimum sample size should be at least 100 cases, whereas Habing (2003) states that minimum number of cases is at least 50. With 88 cases, the sample of this research is small, but it may be sufficient for factor analysis.

### **Number of variables**

In addition, there appears to be a need for a minimum sample to variable ratio. This is the ratio between the number of respondents and the number of variables in the data set. Habing (2003) states that five times as many respondents as variables are needed. Whereas Williams et al., (2012) state that there appears to be no rule of thumb for the minimum acceptable ratio. With 88 cases and 52 variables, there are less than two respondents per variable.

### **KMO and Bartlett's test**

The Kaiser-Meyer-Okin measure of sampling adequacy tests whether the sample is large enough to extract factors reliably. The KMO value of this dataset with its 88 respondents and 52 variables is .527. According to Field (2009), KMO values between 0.5 and 0.7 are mediocre. Thus, the sampling adequacy assumption is satisfied, but not very convincingly. In addition, Bartlett's test of sphericity tests the assumption of equal variances in the dataset. Bartlett's test is significant,  $\chi^2(1326) = 2514.744$ ,  $p = 0.001$ , thus this condition is satisfied.

### **Normal distribution**

To determine if data is normally distributed multiple tests can be performed. The skewness and kurtosis Z-values, the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) test, and the histograms, normal Q-Q plots and box plots have to be investigated. The skewness and kurtosis Z-value is calculated by dividing the skewness and kurtosis measure by its standard error. The resulting Z-value should be between -1.96 and +1.96. The K-S and S-W tests identify whether the data is normally distributed; if the p-value or 'sig.' is below or equal to 0.05 the data is not normally distributed. In addition, the histograms and normal Q-Q plots of the data are visually investigated.

The items of the six-item measurement tool of innovativeness are tested for normality. The Z-value of skewness and kurtosis of the individual items is not consistently between -1.96 and +1.96. In addition, the results of the K-S and S-W tests are below a p-value of 0.001 for all items. It is possible to transform variables in order to increase the normality (Field, 2009). Equation XII is used to transform the data. Because the items are negatively skewed, the absolute variable needs to be reflected. The maximum score for the items on this measurement tool is six.

$$\text{Transformed variable} = \sqrt{(\text{max score variable} + 1) - \text{absolute value}} \quad (\text{XII})$$

After the transformation of the items of the innovation variable, the Z-value for skewness and kurtosis were calculated again, some items had a Z-value between -1.96 and +1.96. However, with the K-S and S-W normality test the items were still below the  $p$ -value of 0.001.

The items of the 18-item measurement tool of intrinsic and extrinsic motivation are tested for normality. The Z-value of skewness and kurtosis of the individual items are not consistently between -1.96 and +1.96. In addition, the K-S and S-W tests were below a  $p$ -value of 0.001 for all items. To increase normality the motivation items are transformed. Of the eighteen items, nine were negatively skewed and nine positively skewed. The negatively skewed items were transformed using equation XII. The positively skewed items were transformed using the square root of the absolute value.

After the transformation of the items of the intrinsic and extrinsic motivation variable, the Z-value for skewness and kurtosis were calculated again, some items had a Z-value between -1.96 and +1.96. However, with the K-S and S-W normality test the items were still below the  $p$ -value of 0.001.

The items of the 28-item measurement tool of creativity were tested for normality. The Z-value of skewness and kurtosis of the individual items was not consistently between -1.96 and +1.96. In addition, of the K-S and S-W tests were below a  $p$ -value of 0.001 for all items.

However, Silvia et al. (2012) performed research on the validity and reliability of creativity measurement tools. Because of the way that the creative behaviour inventory is constructed, the data is positively skewed. This tool measures the number of times that respondents have completed a creative task. Most respondents have not performed these tasks because they are very specific. The authors advise researchers with small sample sizes to transform the raw scores using log transformation, as this increases the normality of the data.

$$\textit{Transformed variable} = \ln \textit{absolute value} \quad (\text{XIII})$$

After the transformation of the items of the creativity variable, the Z-value for skewness and kurtosis were calculated again, some items had a Z-value between -1.96 and +1.96. However, the K-S and S-W for the items were still below the  $p$ -value of 0.001.

The items of the variable of innovation, motivation and creativity were tested for normality. The investigation of the Z-value for skewness and kurtosis and K-S and S-W test for normality show that both the untransformed and transformed items were not normally distributed. The visual investigation of the histograms and normal Q-Q plots show that the transformation did not increase the normality of the items, whereas the untransformed items appear to be approximately normally distributed based on the histograms and normal Q-Q plots. Therefore, it is assumed that the items of the innovation, motivation and creativity variable are approximately normal distributed.



### **Factor extraction and factor rotation**

The initial factor analysis presented seventeen factors with an eigenvalue greater than one, which accounted for 75% of the total variance. It is not realistic to have seventeen factors as the result of a factor analysis with this dataset, especially since the measurement tools used to measure innovativeness, intrinsic motivation and extrinsic motivation and creativity are derived from literature. It was expected to get one factor of the six items of the innovativeness measurement tool and one factor of the 28 items of the creativity measurement tool. In addition, it was expected to get six or two factors of the 18 items of the motivation measurement tool, because the measurement tool consists of six subscales, with three creating the measure of intrinsic motivation and the other three creating the measure of extrinsic motivation.

Adjustments were made to the data set in order to increase the results of the factor analysis. The scree plot shows a visual presentation of the eigenvalues of the factor analysis, which can be used to select the correct number of factors in a factor analysis. At the point where the slope levels off, the number of factors is chosen. In appendix F is the scree plot of the untransformed data set, which suggests a point of inflexion of four factors.

Based on the recommendations of Zhao (2009) steps were performed to try to increase the results of the factor analysis. The items with the lowest individual KMO value were deleted; these are the diagonal values of the anti-image correlation matrix. The lowest individual KMO values were deleted until the overall KMO was above 0.6. In addition, items with low communalities were deleted. Communality is the amount of variance of an item, which is accounted for in all the extracted factors.

The factors were rotated after deleting the items that decreased the results of the factor analysis. Factor rotation does not affect the factors themselves, however, it allows for easier interpretation of the factor loadings. There are two types of rotation: orthogonal and oblique. Orthogonal rotation is based on the assumption that the factors are not related, whereas oblique rotation is based on the assumption that factors are related (Field, 2009). The oblique Direct Oblimin rotation method was chosen, as the literature suggests that the factors are related. The pattern matrix of the factors, after the low individual KMO values and the low communalities are deleted, is presented in appendix G. The KMO value of this dataset with its 88 respondents and 35 variables is .668.

After the factor rotation, the four factors were reduced to three factors. Multiple items were deleted because they cross-loaded with multiple factors or because the item had a low loading. The pattern matrix of the three factors is shown in appendix G. The KMO value of this dataset with its 88 respondents and 31 variables is .693.

Lastly, to test the reliability of the factors, a Cronbach's alpha test was performed. A construct with an  $\alpha$  higher than 0.8 is considered to be reliable (Field, 2009). The construct of creativity has an  $\alpha$

of .851, the construct of motivation has an  $\alpha$  of .866 and the construct of innovation has an  $\alpha$  of .795. Thus, the results of the Cronbach's alpha test indicate that the constructs are reliable.

The attempt to identify underlying factors in the dataset of this research was not successful. After deleting the items with low communalities and low KMO values, the combined KMO value for sampling adequacy increased and the factor analysis resulted in three constructs with high reliability. However, the loading of the items in the three constructs is low. In addition, seven items from the 18 items measurement tool of motivation, 14 items from the 28 items measurement tool of creativity and one item of the six-item measurement tool of innovativeness were removed to increase the loading of the items. The measurement tools have not endured the transformation of the data set as 21 items were deleted from the original 52 items.

Even with the original and transformed dataset, the factor analysis could not be performed to a satisfactory level. This does not indicate that the questionnaire used in this research is invalid or cannot be used for further analysis, but it does indicate that the factor analysis could not be properly performed with this dataset. The reasons for failing to complete the factors analysis successfully are not known, but the assumption for the sample size and number of variables was not satisfied. However, since the measurement tools are based on existing literature and are validated it is assumed that the variables for creativity, intrinsic motivation, extrinsic motivation and innovativeness can be used for further analysis.

## **6.5 Regression assumptions**

Three regressions will be performed to test the hypotheses of this research. The first regression R1 is based on H1. The second and third regressions, R2a and R2b, are based on H2a and H2b. Multiple prerequisites have to be satisfied before the regressions can be performed. These conditions will be discussed for the two models of regression.

### **Variable types**

According to Field (2009) the dependent and independent variables should have certain characteristics. The data from the independent variable should be quantitative. The data from the dependent variable should be quantitative, continuous and unbounded. As stated before, Likert scale data can be assumed as interval data. Thus, the assumptions for the independent and dependent variables are satisfied.

### **Sample size**

According to Field (2009), Green introduces two rules of thumb for the minimum sample size in regression. To test the overall fit of the regression model a minimum sample size of 50 plus 8

multiplied by the number of predictor variables is needed. To test the predictors in the regression model a minimum sample size of 104 plus the number of predictor variables is needed. Based on these rules of thumb, the 88 observations of this research are enough to test the overall fit of the regression model, but not enough to test the individual predictors. However, a graph based on the research of Miles and Shevlin introduced by Field (2009) advises that with two predictor variables and a large to medium effect a minimum of 60 observations is needed. Thus, the sample size of this research is sufficient.

#### **Number of predictor variables**

To perform a reliable regression analysis Field (2009) advises researchers to obtain a certain ratio of predictor variables versus cases. A general rule of thumb is that ten to fifteen cases are needed per predictor variable. Predictor variables are the independent variables in the regression model and the control variables. The regression models incorporate a maximum of 10 predictor variables. With 88 cases, or 8.8 cases per predictor variable, this assumption is not satisfied. However, the assumption is only slightly violated. Therefore, the regression analyses will still be executed.

#### **Correlations and multicollinearity**

To detect strong correlations between independent variables a bivariate correlation test was performed. Multicollinearity between the independent samples decreases the representativeness of the results, it limits the results of the multiple regression and it decreases the importance of predictors. The correlation matrix displays the correlation between variables and the results are shown in table 4. Correlations above 0.8 or 0.9 indicate multicollinearity (Field, 2009).

Extrinsic motivation is positively significant correlated with intrinsic motivation. Position is significantly correlated with intrinsic motivation and gender is significantly correlated with extrinsic motivation. Age is significantly correlated with position and tenure is significantly correlated with age, education and firm size.

However, analysing the correlation matrix in order to detect multicollinearity is a crude method. A sophisticated method for multicollinearity is the variance inflation factor (VIF). Field (2009) states that individual VIF values should not be higher than ten, and that the average VIF value of the model should be higher than one. In addition, related to the VIF is the tolerance statistic, which should not be lower than 0.1 or 0.2. The VIF values and tolerance statistic are presented in appendix H. The tolerance statistics for the independent variables are higher than 0.2. The lowest values are for intrinsic motivation (0.285) and extrinsic motivation (0.291). The VIF value for all independent variables is below ten. The highest VIF values are for intrinsic motivation (3.513) and extrinsic motivation (3.433). The average VIF for the independent and control variables of the first hypothesis is 1.711.

Table 4 – Correlations of independent and control variables.

		Intrinsic Motivation	Extrinsic Motivation	Gender	Position	Age	Tenure	Education	Firmsize	Firmage
Intrinsic Motivation	Pearson Correlation	1								
	Sig. (2-tailed)									
Extrinsic Motivation	Pearson Correlation	.795**	1							
	Sig. (2-tailed)	.000								
Gender	Pearson Correlation	.169	.212*	1						
	Sig. (2-tailed)	.115	.048							
Position	Pearson Correlation	-.231*	-.013	-.199	1					
	Sig. (2-tailed)	.030	.904	.063						
Age	Pearson Correlation	.163	.068	.150	-.276**	1				
	Sig. (2-tailed)	.129	.530	.163	.009					
Tenure	Pearson Correlation	.120	-.059	.151	-.124	.505**	1			
	Sig. (2-tailed)	.266	.583	.161	.249	.000				
Education	Pearson Correlation	-.036	.016	-.057	-.064	-.086	-.226*	1		
	Sig. (2-tailed)	.738	.886	.598	.555	.424	.034			
Firmsize	Pearson Correlation	-.019	-.038	.078	.197	.039	.227*	.099	1	
	Sig. (2-tailed)	.863	.725	.468	.066	.718	.033	.360		
Firmage	Pearson Correlation	.106	-.013	-.021	-.051	.050	.107	-.154	.016	1
	Sig. (2-tailed)	.326	.902	.848	.634	.640	.323	.151	.881	

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix, VIF values and tolerance statistic of the second hypothesis was checked for multicollinearity. Because the hypothesis incorporates a moderation variable, an interaction variable was computed. This interaction variable was calculated by multiplying the centered independent variable with the centered moderation variable. The correlation matrix shows the same control variable correlations as the correlation matrix of the first hypothesis. In addition, it shows high correlation between the product term of intrinsic motivation and creativity and the individual variables: intrinsic motivation and creativity. The same holds true for the extrinsic motivation and creativity correlations.

To counteract this high collinearity, the variables of intrinsic motivation, extrinsic motivation and creativity were centered: the mean was subtracted from the variable and the residuals were multiplied to create a new product term. The correlation matrix shows that there is no high correlation between intrinsic motivation and creativity and the centered product term. The correlation between extrinsic motivation and the centered product term decreased, however the correlation creativity and the centered product term increased in power from .629 to -.882.

The VIF values and tolerance statistics were checked before and after the transformation of the variables. The VIF values of the individual and product terms of the two hypothesis were above 20, which is too high and not acceptable. After the transformation of the variables, the VIF values became acceptable, the tolerance statistics and VIF values are presented in appendix H. The tolerance statistics are above 0.2 for all variables. After the transformation of the variables, the correlation matrix, the tolerance statistics and the VIF values showed no sign of multicollinearity in regression model 2a. The tolerance statistics for creativity and the centered product term of extrinsic motivation and creativity

are 0.201 and 0.207 respectively. In addition, the VIF values for creativity and the centered product term of extrinsic motivation and creativity are 4.974 and 4.820 respectively.

Overall, according to the rules of thumb of Field (2009) there appears to be no multicollinearity in the regression models 1 and 2a. However, the collinearity of creativity and the centered product term of extrinsic motivation and creativity, the high VIF values of creativity and the centered product term of extrinsic motivation and creativity and the high average VIF in regression model 2b may indicate some concerns about multicollinearity. Thus, the results of regression model 2b should be taken with caution.

Table 5 – *Standardized residuals and statistics for influential cases*

Standardized Residual	Mahalanobis Distance	Cook's Distance	Centered Leverage Value
3.18533	10.43041	0.17629	0.11989
3.17539	14.31876	0.25633	0.16458
1.82333	12.04102	0.06926	0.1384
-1.50074	11.43801	0.04267	0.13147
-1.64154	7.35354	0.03085	0.08452
-2.73477	12.87055	0.16645	0.14794

### Case wise diagnostics

To control for outliers in the data of the model the standardised residuals and the statistics for influential cases were tested. The three highest and lowest standard residuals in this dataset, accompanied with the corresponding statistics for influential cases, are presented in table 5.

According to Field (2009) 95% of the cases should have a standardised residual value between -1.96 and 1.96 if the model is a good representation of the data. With a sample of 88 cases, four cases are allowed to be lower than -1.96 and higher than 1.96, and as table 5 shows there are three cases outside of this range, which is acceptable. The three standardised residual values are lower than -2.58 and higher than 2.58 and must be omitted, because the standardised residual of 99% of the cases of this dataset should be between these values (Field, 2009).

The statistics for influential cases were also checked for extreme cases. The Mahalanobis distance: “measures the distance of cases from the means of the predictor variables” (Field, 2009). The table of Chi-square statistics shows that with a *p*-value of 0.001 and nine degrees of freedom (two independent variables and seven control variables) the cut off value for the Mahalanobis distance is 27.88. None of the cases has a Mahalanobis distance value higher than 27.88. Cook’s distance determines the effect of one case on the overall model. According to Field (2009) a Cook’s value higher than one is cause for concern. None of the cases has a Cook’s distance value higher than one.

In addition, the Centered Leverage Value or Leverage was checked for extreme values. The cut off value for Leverage is twice the number of predictors plus one, divided by the total number of cases. The number of predictor variables is nine and the number of cases is 88, therefore the cut off value is;

$2*(9+1)/88 = 0.2273$ . For the Leverage value of the first hypothesis, one case has a Leverage value higher than the cut off value and for hypothesis 2b three cases have a Leverage value higher than the cut off value.

To conclude, Mahalanobis distance, Cook's distance and Centered Leverage Value were checked for influential cases. Based on the influential statistics there was no reason to delete cases. However, the standardised residual of three cases was too high, therefore they were deleted from the dataset.

### Normality of residuals

According to Field (2009) the normality of residuals is an important assumption when performing a regression analysis. There are two methods of determining the normality of residuals: visually inspecting the histogram and normal P-P plot, and using the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) test. The histogram and normal P-P plot of the standardized residual of the first regression model is shown in figure 7.

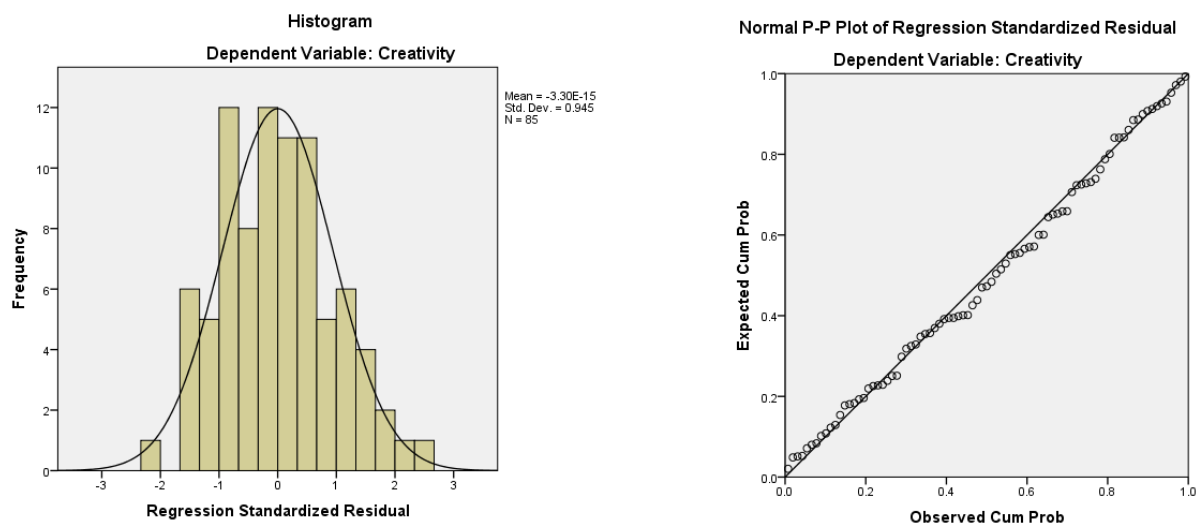


Figure 7 – Histogram and normal P-P plot of standardised residual

In the histogram, the line is the shape of a normal distribution and the bars are the actual observed values. In the normal P-P plot, the points are the actual observed values and the line is the normal distribution. Based on the histogram and normal P-P plot it is assumed that the residuals are approximately normally distributed. In addition, the standardised residual is normally distributed according to the K-S test of normality,  $D(85) = .063$ ,  $p = .200$ , and the S-W test of normality,  $W(85) = .991$ ,  $p = .808$ .

The standardised residuals of the other two regression models were also checked for normality. Their histograms and normal P-P plot indicated an approximately normal distribution. The K-S test for normality indicated that the standardised residuals were normally distributed. However, the S-W test for normality did not indicate that the standardised residuals were normally distributed.

Nevertheless, based on the visual investigation and the normality test it was assumed that the standardised residuals were normally distributed.

**Homoscedasticity**

Homoscedasticity is the assumption that the variance of the residuals is constant. A visual representation of the standardised predicted value versus the standardised residual shows whether the variance of the residuals is constant and this scatterplot is presented in figure 8. The individual residuals should be between minus three and three on both axes. The values in the figure should be random and evenly dispersed (Field, 2009). There appears to be some mild heteroscedasticity as the values spread out. However, the residuals appear to meet the assumption of homoscedasticity as the values are randomly dispersed around zero. The assumption of homoscedasticity also holds for the residuals of the two other regression models.

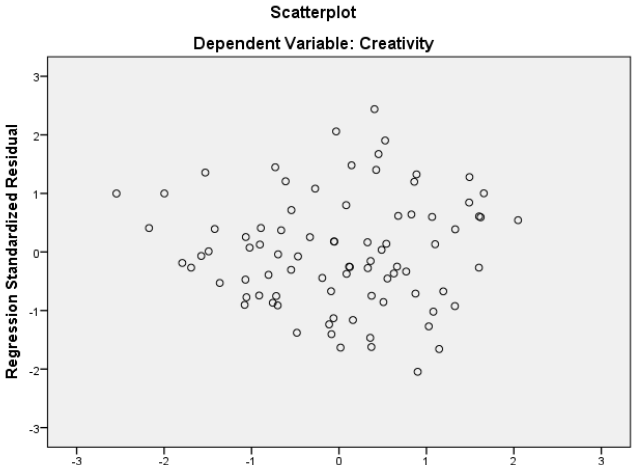


Figure 8 – Homoscedasticity

**6.6 Regression analysis**

In this subchapter, regression analyses are performed to test the three hypotheses. The overall regression model and the strength of the constructs will be tested. The first regression is based on the mediation hypothesis, and three regressions, a Sobel test and the bootstrapping method are performed to test this hypothesis. The second and third regressions are based on the moderation hypothesis. The assumptions for regression are tested and are satisfied for the three regression analyses.

**Regression H1**

Table 6 presents the results of the regressions performed to test the first hypothesis. The regressions are performed with 85 observations. The unstandardised regression coefficient, *B*, indicates the change in the dependent variable when the independent variable changes by one unit

and its standard error (SE B). The standardised regression coefficient,  $\beta$  or beta, indicates the change of the standard deviation in the dependent variable when the independent variable changes by one unit, while controlling for the other independent variables in the model.  $R^2$  is the amount of variance explained by the independent variables and indicates if the model is a good fit. In the table, significant data is indicated with an asterisk and the bold values indicate the relevant data of each regression.

Preacher & Hayes (2004) state that variable M is a mediator if the relation in path c, path a, path b and path c' is significant. If one of these relations is not significant, the analysis should not be continued. In addition, the Sobel test was performed to test the mediation hypothesis.

Table 6 – Model summary of mediation analysis

Variable	Step 1			Step 2			Step 3		
	Path c – X predicts Y			Path a – X predicts M			Path b – M predicts Y Path c' – X predicts Y Controlling for M		
	B	SE B	$\beta$	B	SE B	$\beta$	B	SE B	$\beta$
Intrinsic motivation							<b>0.17</b>	<b>0.08</b>	<b>0.37*</b>
Extrinsic motivation	<b>-0.06</b>	<b>0.04</b>	<b>-0.15</b>	<b>0.78</b>	<b>0.06</b>	<b>0.81**</b>	<b>-0.19</b>	<b>0.07</b>	<b>-0.45**</b>
Gender	<b>-0.24</b>	<b>0.08</b>	<b>-0.29**</b>	<b>-0.13</b>	<b>0.12</b>	<b>-0.07</b>	<b>-0.22</b>	<b>0.08</b>	<b>-0.26**</b>
Position	<b>0.09</b>	<b>0.06</b>	<b>0.14</b>	<b>-0.30</b>	<b>0.09</b>	<b>-0.22**</b>	<b>0.14</b>	<b>0.06</b>	<b>0.22*</b>
Age	<b>0.02</b>	<b>0.00</b>	<b>0.52**</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.00</b>	<b>0.52**</b>
Tenure	<b>0.00</b>	<b>0.00</b>	<b>0.06</b>	<b>0.01</b>	<b>0.01</b>	<b>0.12</b>	<b>0.00</b>	<b>0.00</b>	<b>0.02</b>
Education	<b>0.04</b>	<b>0.04</b>	<b>0.12</b>	<b>-0.04</b>	<b>0.05</b>	<b>-0.04</b>	<b>0.05</b>	<b>0.04</b>	<b>0.13</b>
Firmsize	<b>0.01</b>	<b>0.02</b>	<b>0.04</b>	<b>0.01</b>	<b>0.02</b>	<b>0.04</b>	<b>0.00</b>	<b>0.02</b>	<b>0.02</b>
Firmage	<b>0.00</b>	<b>0.00</b>	<b>0.06</b>	<b>0.00</b>	<b>0.00</b>	<b>0.07</b>	<b>0.00</b>	<b>0.00</b>	<b>0.03</b>
R <sup>2</sup>		<b>.38</b>			<b>.72</b>			<b>.42</b>	
F		<b>5.79**</b>			<b>24.69**</b>			<b>5.96**</b>	

Note: \*p < .05. \*\*p < .01.

The first step, path c, is the direct effect of extrinsic motivation on creativity. The results of the first step indicate that extrinsic motivation has a negative but insignificant influence on M. The first criterion for determining that variable M is a mediator is not satisfied, however the analysis is continued as the analysis of the other paths provides interesting results and can indicate the mediation of the variable M. In addition, gender has a negative significant influence on creativity and age has a negative positive influence on creativity. The  $R^2$  value indicates that the model in step 1 is not a good fit.

The second step, path a, is the direct effect of extrinsic motivation on intrinsic motivation and the results indicate that extrinsic motivation has a significant positive influence on intrinsic motivation. Thus, the second criterion is satisfied. In addition, position has a negative significant influence on intrinsic motivation and the  $R^2$  value indicates that the model in step 2 is a good fit.

In the third step, two relations were examined: the direct effect of intrinsic motivation on creativity (path b) and the direct effect of extrinsic motivation on creativity after controlling for intrinsic motivation (path c'). The results indicate a significant positive relation between intrinsic motivation and creativity, and a significant positive relation between extrinsic motivation and creativity after controlling for intrinsic motivation. However, Preacher & Hayes (2004) state that when the effect of X



(extrinsic motivation) on Y (creativity) is not equal to zero, partial mediation occurs. The third step allows for the determination of the third and the fourth criteria, and both criteria are satisfied. In addition, gender has a negative significant influence on creativity and age has a negative positive influence on creativity. The  $R^2$  value indicates that the model in step 1 is not a good fit. The standardised regression coefficients of the four paths are presented in figure 9.

The Sobel test was performed using the PROCESS macro in SPSS discussed by Hayes (2012). The results of the Sobel test are  $Z = 2.17, p = .03$  which indicates that there is a significant relationship between extrinsic motivation and creativity which is mediated by intrinsic motivation. In addition, the PROCESS macro allows testing for mediation with the bootstrapping method. A 95% confidence interval with 5.000 bootstrapping resamples was used. The results of the bootstrapping method were significant if the confidence interval does not cross zero. The results indicate that the mediation effect of intrinsic motivation,  $B = .08, CI = .02 \text{ to } .20$  is significant.

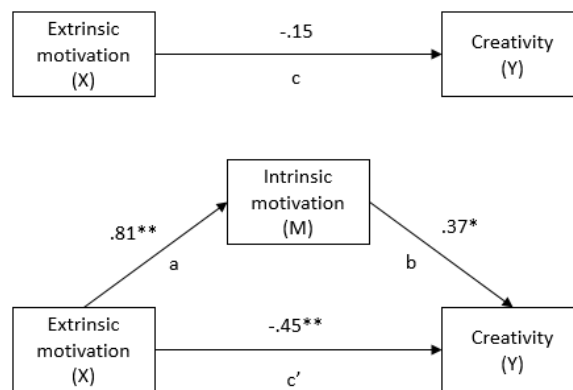


Figure 9 – Mediated relationship between extrinsic motivation and creativity with intrinsic motivation as the mediator.

## Regression H2a & H2b

Intrinsic motivation and extrinsic motivation in combination with creativity are used to predict the innovativeness of a company. As stated before, the data was checked and the assumptions for regression were not violated. Table 7 presents the results of the regressions performed in order to test the second hypothesis. The regressions are performed with 85 observations.

Table 7 – Model summary for moderation analyses

Variable	Model 2a			Model 2b		
	B	SE B	t	B	SE B	t
Creativity	0.18	0.39	0.48	0.21	0.37	0.56
Intrinsic motivation	-0.02	0.18	-0.08			
Interaction variable h2a	0.31	0.61	0.52			
Extrinsic motivation				-0.06	0.15	-0.42
Interaction variable h2b				0.59	0.44	1.35
Gender	-0.02	0.39	-0.06	0.02	0.38	0.05
Position	-0.23	0.23	-0.99	-0.24	0.23	-1.08
Age	0.01	0.01	0.50	0.01	0.01	0.51
Tenure	-0.01	0.01	-0.65	-0.01	0.01	-0.83
Education	-0.01	0.13	-0.04	-0.02	0.13	-0.17
Firmsize	0.00	0.07	0.05	0.01	0.07	0.15
Firmage	-0.02	0.01	-2.62*	-0.01	0.01	-2.48*
R <sup>2</sup>		.10			.12	
F		1.15			1.45	

Note: \*p < .05. \*\*p < .01.

Testing hypothesis 2a, the overall model of intrinsic motivation and creativity are insignificant predictors of innovativeness. Intrinsic motivation does not significantly affect innovativeness and creativity does not significantly affect innovativeness. In addition, the interaction between intrinsic motivation and creativity does not affect innovativeness. The figure in appendix I depicts the interaction between intrinsic motivation and creativity. Although low, average and high creativity do not significantly affect innovativeness with increasing degrees of intrinsic motivation, the figure presents one interesting relationship. There is no change in the relation between low, average and high intrinsic motivation and creativity, except for high intrinsic motivation and low creativity, which shows a high increase in innovativeness. Low creativity is one standard deviation below the mean, average creativity is the mean and high creativity is one standard deviation above the mean.

Testing hypothesis 2b, the overall models of extrinsic motivation and creativity are insignificant predictors of innovativeness. Extrinsic motivation does not significantly affect innovativeness and creativity does not significantly affect innovativeness. In addition, the interaction between extrinsic motivation and creativity does not affect innovativeness. The figure in appendix I depicts the interaction between extrinsic motivation and creativity. Although low, average and high creativity do not significantly affect innovativeness with an increasing degree of extrinsic motivation, there are some interesting relationships between the predictor variables and innovativeness. The figure shows that for individuals with low creativity if their extrinsic motivation increases, the innovativeness of their

employer decreases. In addition, the figure shows that for individuals with high creativity, if the extrinsic motivation decreases the innovativeness of their employer decreases.

In addition, the measurement tool of motivation allows for the creation of one index for motivation instead of two. This index for motivation is calculated by multiplying the means of the subscale with its corresponding weight and then summing these scores. Since the data satisfies the necessary assumptions for performing regression analysis it is assumed that the assumptions are also satisfied for this regression analysis. The relation between motivation and innovation has been tested to ascertain whether it is affected by creativity. The model indicates that motivation and creativity are insignificant predictors of innovativeness,  $F(10, 74) = 1.23$ ,  $p = .29$ ,  $R^2 = .12$ . In addition, all predictor variables have an insignificant effect on innovativeness except for firm age.

The results of the first regression support the mediation hypothesis: extrinsic motivation does affect creativity through its effect on intrinsic motivation. However, this effect does not match that of the hypothesis, and thus the first hypothesis is rejected. The results of the second and third regression do not support the moderation hypothesis. Intrinsic motivation does not significantly affect innovativeness and creativity does not significantly increase the effect of intrinsic motivation on innovativeness. Extrinsic motivation does not significantly affect innovativeness and creativity does not significantly decrease the effect of extrinsic motivation on innovativeness. In addition, the single measure of motivation does not significantly affect innovativeness and creativity does not significantly affect this relation.

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## 7 Discussion

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In this chapter, the results of the regression analysis are compared to the existing theory. A short introduction of the problem statement and research method is presented. The limitations of this research are discussed as well as its implications. In addition, the chapter ends with recommendations for future research.

An illegal no-poacher agreement between multiple high-tech companies limited the natural course of employment and harmed shareholders by hampering the rate of innovation in these organisations. In addition, this agreement reduced the bargaining power of employees and their mobility, resulting in lower industry-wide wages, which could affect the motivation of employees. This research investigated how intrinsic motivation, extrinsic motivation and creativity affect the innovation capability of high-tech companies.

The research method is based on the cross-sectional research design. The Dutch high-tech sector provides the population of this research, which utilises information from the Chamber of Commerce. The sample is derived from the population, however companies in the sector of research and development, and installation and reparation are excluded. Innovation capability, the dependent variable, is measured with a six-item tool to measure innovativeness. Motivation and creativity, the independent variables, are measured with an 18-item and a 28-item measurement tool respectively. The primary data was gathered using self-administered questionnaires that were emailed to employees of Dutch high-tech companies. The control variables were provided by the respondents with the questionnaire.

Factor analysis was performed to reduce the number of items on the questionnaire by grouping the items into underlying factors. The regression models were formulated and the regressions performed. The first hypothesis incorporates a mediation variable and required additional testing in the form of a Sobel test and the bootstrapping method. The second hypothesis incorporates a moderating variable and required a moderated multiple regression model.

### 7.1 Results

The first regression was performed to test the mediation effect of intrinsic motivation on the relation between extrinsic motivation and creativity. According to Woodman, Sawyer & Griffin (1993) and Amabile (1997), intrinsic motivation affects creativity positively. Amabile et al. (1994) state that intrinsic motivation is positively correlated with creativity and that extrinsic motivation is negatively correlated with creativity. Ryan & Deci (2000b) add that intrinsically motivated individuals are more creative than extrinsically motivated individuals. The crowding-out theory tries to explain the decrease

in intrinsic motivation after the introduction of extrinsic motivators. Some authors, like Deci, Ryan, & Knoester (1999), support this theory, while others, like Cameron & Pierce (1994), oppose it. In addition, it is assumed that intrinsic and extrinsic motivation are two distinct processes of motivation and not two types of motivation that are on the same motivational spectrum.

Because the first regression incorporates a mediation variable, multiple regressions were performed to support the first hypothesis. The results of the first regression indicate that extrinsic motivation has a negative but insignificant effect on creativity. The effect of this relation is expected, but its insignificance signals that there is no mediation effect. The model appears to be a moderate fit, as it explains 0.38 of the total variance. In addition, gender has a significant negative effect and age has a positive significant effect on creativity. This indicates that females are more creative than males. In addition, the results indicate that older people are more creative than younger people are, albeit the increase in creativity per extra year is very small. Although the direct effect of extrinsic motivation and creativity is insignificant, the analysis was continued because the other regressions provided interesting results.

The results of the second regression indicate that extrinsic motivation has a positive and significant effect on intrinsic motivation. In this model, an increase in extrinsic motivation results in a strong increase in intrinsic motivation. This is contrary to expectations, because it was assumed that extrinsic motivation has a crowding-out effect on intrinsic motivation. The model appears to be a good fit, as it explains 0.72 of the total variance. In addition, position has a negative significant effect on intrinsic motivation and this indicates that compared to non-managers, managers are more intrinsically motivated.

The results of the third regression indicate that intrinsic motivation has a positive and significant effect on creativity. The positive effect of intrinsic motivation on creativity was expected based on the literature. In addition, extrinsic motivation has a negative and significant effect on creativity, when controlled for intrinsic motivation. The model appears to be a moderate fit, as it explains 0.42 of the total variance. Similar to the first regression, gender has a negative significant effect on creativity and age has a positive significant effect. In addition, position has a positive significant effect on creativity.

There are two types of mediation, full or partial. Full mediation occurs when the direct relation between extrinsic motivation and creativity decreases to zero after including intrinsic motivation. Since that is not the case there is partial mediation between extrinsic motivation and creativity.

The results of the Sobel test indicate a significant mediation effect. Thus, according to these results the indirect effect of extrinsic motivation on creativity through intrinsic motivation is significant. The results of the bootstrapping method indicate that there is a significant mediation effect. However, the Sobel test and the bootstrapping method provided no indication about the strength of this effect,

only that there is a significant mediation effect. Although the total effect of extrinsic motivation on creativity is insignificant, the results indicate a significant indirect effect, which is supported by the Sobel test and the bootstrapping method. There is a mediation effect, however this does not match the hypothesis because extrinsic motivation has a positive effect on intrinsic motivation instead of a negative effect.

The second regressions were performed to test the moderation effect of creativity on the relation between intrinsic and extrinsic motivation and innovation. According to the results of Hammond et al. (2011) intrinsic motivation is positively related to individual level innovation and extrinsic motivation less positively. The results of Cerasoli et al. (2014) indicate that intrinsic motivation is the best indicator of quality dependent performance and that extrinsic motivation is the best indicator of quantity dependent performance. It was assumed that innovation is a qualitative activity, therefore intrinsic motivation has a positive relation and extrinsic motivation a negative one. Creativity is an important supplier in the organisational innovation process and therefore positively affects the relation between motivation and innovation.

The results of the first regression indicate that creativity and the interaction variable of creativity and intrinsic motivation have a positive effect on innovation, and intrinsic motivation has a small negative effect on innovation. No generalisations can be made for the total population, as these relations are insignificant. However, as expected, creativity has a positive effect on innovation. Contrary to what was expected, intrinsic motivation has a negative effect on innovation. The interaction between intrinsic motivation and creativity has a positive effect on innovation. The model appears not to be a good fit, as it explains only 0.10 of the total variance.

The results of the second regression indicate that creativity and the interaction variables of creativity and extrinsic motivation have a positive effect on innovation, and extrinsic motivation has a small negative effect on innovation. No generalisations can be made for the total population, as these relations are insignificant. However, as expected, creativity has a positive effect on innovation and extrinsic motivation has a negative effect on innovation. The interaction between extrinsic motivation and creativity has a positive effect on innovation. The model appears not to be a good fit, as it explains only 0.12 of the total variance. Aside from the control variable age of respondents, in both regressions, none of the variables has a significant effect on innovativeness.

## **7.2 Implications**

In science, an idea arises, which is supported with literature and transformed into a hypothesis. If enough hypotheses are tested, and if they pass enough tests they can be considered a theory. This theory is considered the truth, until a new idea arises that is transformed into a hypothesis. Which results in many hypotheses tested and if these hypotheses pass enough tests, a new theory arises.

This research builds on an idea based on existing literature and theory and real life phenomena. The results indicate that the creativity of people working in the Dutch high-tech sector is affected by intrinsic motivation as well as by extrinsic motivation. In addition, there is no crowding-out effect of extrinsic motivation on intrinsic motivation in the mediation relation. According to the results of this research, there is no direct significant effect of extrinsic motivation on creativity, but extrinsic motivation negatively affects creativity when controlling for intrinsic motivation. However, this effect appears to be countered by the positive effect of extrinsic motivation on intrinsic motivation, and the positive effect of intrinsic motivation on creativity. The creativity of employees working at Dutch high-tech companies can be increased by increasing their intrinsic motivation. Moreover, the negative effect of extrinsic motivation on creativity appears to be somewhat balanced by the mediation effect of intrinsic motivation.

The results of this research indicate that extrinsic motivation has no direct effect on creativity. However, when controlling for intrinsic motivation, extrinsic motivation has a negative effect on creativity and a positive effect on intrinsic motivation and intrinsic motivation has a positive effect on creativity. Thus for the people working at the Dutch high-tech companies the negative effect of increasing extrinsic motivation on creativity is partially mediated by the positive effect of intrinsic motivation.

No implications can be obtained from the results of the second hypothesis, as the results were insignificant. Although the analysis of this hypothesis indicated a few interesting results, they cannot be generalised.

### **7.3 Limitations**

The positive and significant relation between intrinsic motivation and creativity does not indicate that intrinsic motivation is the cause of creativity. However, the results indicate correlation, which means that if intrinsic motivation increases, creativity increases as well. Without assuming which variable causes the other variables, correlation provides an estimate of the relation between intrinsic motivation and creativity. Thus, the results of this research imply correlation and not causation.

There are two units of analysis in this research, the employees in a managerial position working at Dutch high-tech companies and the Dutch high-tech companies where these respondents are working. In this research, one respondent is the representative of one high-tech company. The high-tech companies are represented well, the response rate of the questionnaire in this research is sufficient. One employee can be a good representation of a company if the company is small. However, if the unit of analysis is a company with many employees, one employee is not a good representation of the company.

Self-report tools are used to measure intrinsic and extrinsic motivation, creativity and innovation capability variables. These tools have been tested and validated in previous research, therefore it can be assumed that the tools measure what they claim to measure. However, no study combines these three measurement tools into one questionnaire. A factor analysis was performed to determine if the items of a measurement tool measure what they are supposed to measure. However, the factor analysis was not completed to a satisfactory level, as it did not detect the expected underlying dimensions. Therefore, in this research, it is not confirmed that the measurement tools measured what they were supposed to measure. The sample size and the number of respondents per variable for the factor analysis were assumed acceptable but they were on the low side.

There are some risks with validity of data when using self-reporting measures, because a researcher has only limited control in the survey process. One risk is that the respondent completing the questionnaire is not honestly answering the questions and tries to manage the results of the questionnaire. Another risk is the potential inability of people to answer questions about themselves honestly, because respondents may view themselves differently than that other people view them. It is also a possibility that respondents do not understand a question or that respondents have differing interpretations of a question. In addition, there is a risk in the tendency of respondents to respond in a certain way be caused by differences in experience, habits or preferences. This response bias occurs when respondents answer, regardless of evidence. For example, the measurement tool for innovativeness can be answered with six items, ranging from 'strongly disagree' to 'strongly agree'. In the same company, one respondent rates their employer as 'strongly agree' on an innovativeness item, while another respondent rates their employer as 'moderately agree'.

Although the data in the questionnaire is assumed to be interval data, it is difficult to interpret the results of the regression analysis when the data is gathered using a Likert scale. For example, the results of the first regression model indicate that an increase of 1 intrinsic motivation results in a 0.17 increase in creativity. On the scale of 1 'never did this' to 4 'did this more than five times' of creativity, an increase of 0.17 is difficult to interpret.

In this research, it is assumed that intrinsic motivation and extrinsic motivation are two distinct processes. However, the results of the first regression model indicate that intrinsic motivation and extrinsic motivation are highly related. The data was checked for multicollinearity, and although the values for multicollinearity were high, it was assumed that they would not limit the regression analysis and limit the interpretation of the results of this analysis.

In addition, the measure for organisational innovation capability appears to be weak. The data was obtained with the use of self-reporting measurement tools and the innovation capability construct did not use any objective secondary data. This measure for organisational innovation capability was



not able to measure the innovation capability of companies to a satisfactory level, which greatly limited the analysis of the second hypothesis.

#### **7.4 Recommendations for future research**

The results of this research indicate interesting areas of research. As stated before, based on the literature it was hypothesized that there would be negative relation between extrinsic motivation and intrinsic motivation. However, the results indicate a strong positive relation. Although there is evidence in literature for extrinsic motivation not crowding-out intrinsic motivation, the results were unexpected. In addition, in this research it was assumed that intrinsic and extrinsic motivation are two distinct processes in the motivational spectrum. However, the results show that the two are highly related and this may indicate that the two are not distinctive processes.

Future research could build on this research and make some improvements. One improvement would be that data from multiple respondents from the same company are gathered, as it would increase the representativeness of the company and increase the generalisability of the results. However, it would take considerable resources to survey multiple employees from the companies in the sample. Another improvement would be to include objective secondary data for the measurement of the innovation capability of companies, as the data is now gathered with the use of self-reporting measurement tools.

#### **7.5 Conclusion**

This research investigated how intrinsic and extrinsic motivation and creativity of employees affect the innovation capability of high-tech companies. After extensive overview and review of the literature two hypothesis were drafted. The first hypothesis is based on the mediation relation between extrinsic motivation and creativity through intrinsic motivation. The second hypothesis is a based on the moderation relation between intrinsic and extrinsic motivation and organizational innovation capability, and the effect of creativity on this relation. The results from the first hypothesis indicate that there is a mediation effect between extrinsic motivation and creativity through intrinsic motivation. However, this effect is different than was hypothesized, as extrinsic motivation appears to have a strong positive effect on intrinsic motivation. In addition, as was hypothesized extrinsic motivation has a negative effect on creativity and intrinsic motivation has a positive effect on creativity. In addition, the results from the second hypothesis were insignificant and therefore no generalizations can be made on the effect of creativity on the relation between intrinsic and extrinsic motivation and organizational innovation capability. Although this research informs about the effect of extrinsic and intrinsic motivation on creativity, it does not provide information of the effect these variables on innovation capability. Thus, there is no answer on how intrinsic and extrinsic motivation and creativity affect the innovation capability of high-tech companies.

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## 9 Appendix

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### Appendix A

SBI 2008	Toelichting SBI code
2611	Vervaardiging van overige elektronische componenten
2612	Vervaardiging van elektronische printplaten
2620	Vervaardiging van computers en randapparatuur
2630	Vervaardiging van communicatieapparatuur
2640	Vervaardiging van audio- en videoapparatuur
2651	Vervaardiging van meet-, regel-, navigatie- en controleapparatuur
2660	Vervaardiging van bestralingsapparatuur en van elektromedische en elektrotherapeutische apparatuur
2670	Vervaardiging van optische instrumenten en apparatuur
2712	Vervaardiging van schakel- en verdeelinrichtingen
2731	Vervaardiging van kabels van optische vezels
2732	Vervaardiging van overige elektrische en elektronische kabel
2733	Vervaardiging van schakelaars, stekkers, stopcontacten e.d.
2790	Vervaardiging van overige elektrische apparatuur
2931	Vervaardiging van elektrische en elektronische onderdelen en toebehoren voor auto's
3030	Vervaardiging van vliegtuigen en onderdelen daarvoor (geen vliegtuigstoelen)

### Appendix B

#### Firm innovativeness

By Lin (2007) based on the work of Calantone (2002).

Using the scale below, please indicate to what extent each of the following items corresponds to the company you are working for.

- Strongly disagree.
  - Moderately disagree.
  - Slightly disagree.
  - Slightly agree.
  - Moderately agree.
  - Strongly agree.
- 
- Our company frequently tries out new ideas.
  - Our company seeks out new ways to do things.
  - Our company is creative in its methods of operation.
  - Our company is often the first to market with new products and services.
  - Innovation in our company is perceived as too risky and is resisted.
  - Our new product introduction has increased over the last 5 years



## Appendix C

### Work extrinsic and intrinsic motivation scale.

By Tremblay, Blanchard, Taylor, Pelletier & Villeneuve, 2009.

Using the scale below, please indicate to what extent each of the following items corresponds to the reason why you are presently involved in your work. Here is the scale:

- a. Does not correspond at all.
  - b. Corresponds a little.
  - c. Corresponds moderately.
  - d. Corresponds a lot.
  - e. Corresponds exactly.
- 
1. Because this is the type of work I chose to do to attain a certain lifestyle.
  2. For the income it provides me.
  3. I ask myself this question, I do not seem to be able to manage the important tasks related to this work.
  4. Because I derive much pleasure from learning new things.
  5. Because it has become a fundamental part of who I am.
- 
6. Because I want to succeed at this job, if not I would be very ashamed of myself.
  7. Because I chose this type of work to attain my career goals
  8. For the satisfaction I experience from taking on interesting challenges.
  9. Because it allows me to earn money.
  10. Because it is part of the way in which I have chosen to live my life.
- 
11. Because I want to be very good at this work, otherwise I would be very disappointed.
  12. I do not know why, we are provided with unrealistic working conditions.
  13. Because I want to be a "winner" in life.
  14. Because it is the type of work I have chosen to attain certain important objectives.
  15. For the satisfaction I experience when I am successful at doing difficult tasks.
- 
16. Because this type of work provides me with security.
  17. I don't know, too much is expected of us.
  18. Because this job is a part of my life.

*Note.* Intrinsic motivation = 4, 8, 15; integrated regulation = 5, 10, 18; identified regulation = 1, 7, 14; introjected regulation = 6, 11, 13; external regulation = 3, 12, 17.

## Appendix D

### Creative behaviour inventory.

By Dollinger (2003)

Using the scale below, please indicate the answer that best describes the frequency of the behaviour in your adolescent and adult life.

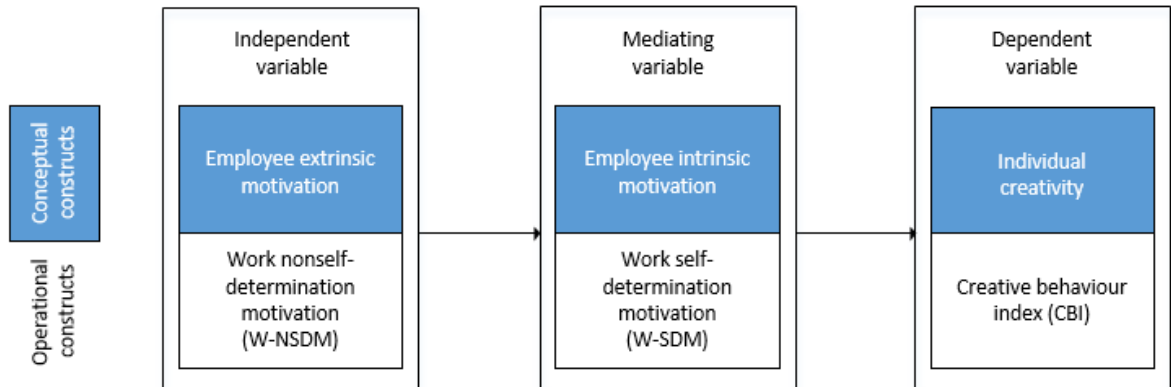
In some cases, you cannot count activities school-related assignments. This is explicitly stated in the question with the following phrase: "excluding school or university course work". In all other cases, you can count school-related assignments.

- a. Never did this.
- b. Did this once or twice.
- c. Did it 3 - 5 times.
- d. Did it more than 5 times

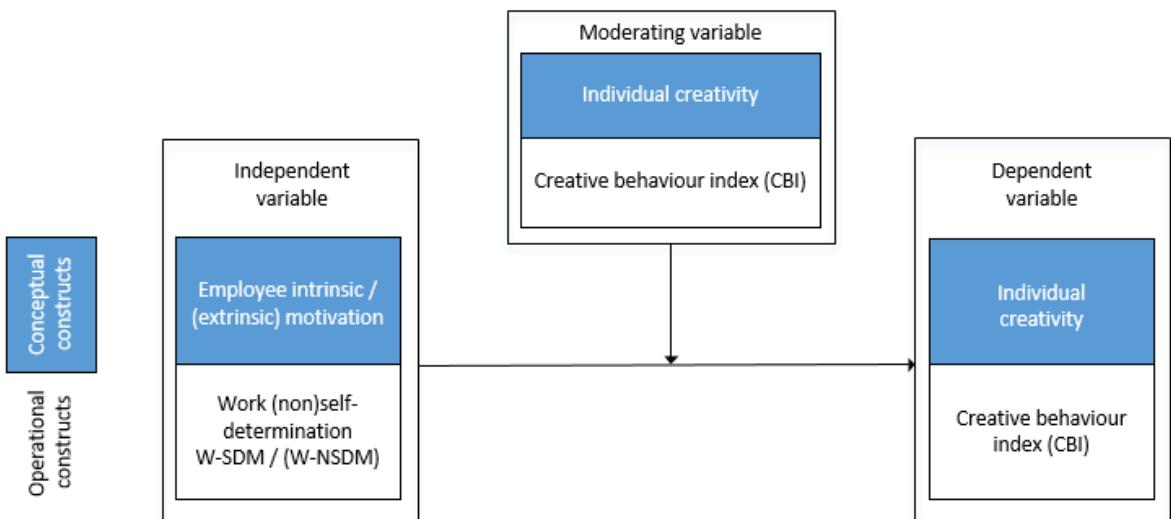
1. Painted an original picture (excluding school or university course work).
2. Designed and made your own greeting cards.
3. Made a craft out of metal (excluding school or university course work).
4. Put on a puppet show.
5. Made your own holiday decorations.
  
6. Built a hanging mobile (excluding school or university course work).
7. Made a sculpture (excluding school or university course work).
8. Made a sculpture (excluding school or university course work). Did it more than 5 times.
9. Had a piece of literature (e.g, poem, short stories, etc.) published in a school or university publication.
10. Wrote poems (excluding school or university course work).
  
11. Wrote a play (excluding school or university course work).
12. Received an award for making a craft.
13. Made a craft out of plastic, plexiglass, stained glass or a similar material (excluding school or university course work).
14. Made cartoons.
15. Made a leather craft (excluding school or university course work).
  
16. Made a ceramic craft (excluding school or university course work).
17. Designed and made a piece of clothing (excluding school or university course work).
18. Prepared an original floral arrangement.
19. Drew a picture for aesthetic reasons (excluding school or university course work).
20. Wrote the lyrics to a song (excluding school or university course work).
  
21. Wrote a short story (excluding school or university course work).
22. Planned and presented an original speech (excluding school or university course work).
23. Made jewelry (excluding school or university course work).
24. Had art work or craft work publicly exhibited.
25. Assisted in the design of a set for a musical or dramatic production (excluding school or university course work).
  
26. Kept a sketch book (excluding school or university course work).
27. Designed and constructed a craft out of wood (excluding school or university course work).
28. Designed and made a costume.

## Appendix E

Libby box hypothesis 1

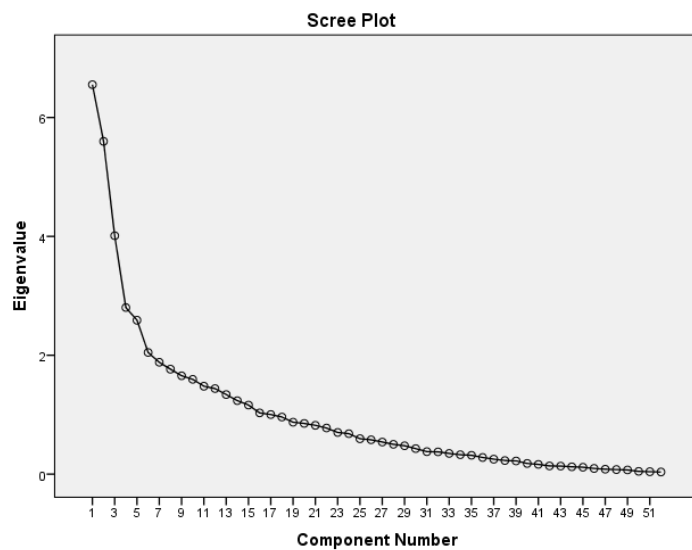


Libby box hypothesis 2



## Appendix F

Scree plot of untransformed dataset.



## Appendix G

Left: pattern matrix and KMO value after deletion low individual KMO values and low communalities.

Right: pattern matrix and KMO value after removing one factor and deleting items with cross loadings.

<i>Pattern Matrix<sup>a</sup></i>				
	Component			
	1	2	3	4
Intrinsic1M4		.245		.235
Intrinsic1M8		.559		
Intrinsic1M15		.714		
Intrinsic2M5		.594		.248
Intrinsic2M10		.684		
Intrinsic2M18		.620		
Intrinsic3M7		.684		
Intrinsic3M14		.708		.300
Extrinsic1M6		.717		
Extrinsic1M11		.730		
Extrinsic1M13		.758		
Extrinsic2M9	-.236	.281	-.209	
Extrinsic3M12			-.228	.692
Extrinsic3M17			-.346	.604
Creativity_1	.238	-.204	.388	.345
Creativity_2	.644	-.255		
Creativity_4	.585			-.354
Creativity_5	.702			
Creativity_6	.643			
Creativity_7	.592			
Creativity_13				.600
Creativity_15	.472			.371
Creativity_16	.400			.229
Creativity_17	.879			
Creativity_18	.730			
Creativity_19	.553		.220	
Creativity_23	.654			
Creativity_25	.406			
Creativity_27				.552
Creativity_28	.679			-.277
Innovation_1			.849	
Innovation_2			.860	
Innovation_3			.765	
Innovation_4			.563	-.262
Innovation_6			.635	

Extraction Method: Principal Component Analysis.  
 Rotation Method: Oblimin with Kaiser Normalization.  
 a. Rotation converged in 9 iterations.

<i>KMO and Bartlett's Test</i>		
Kaiser-Meyer-Olkin		.668
Bartlett's Test of Sphericity	Approx. Chi-Square	1562.989
	df	595
	Sig.	.000

<i>Pattern Matrix<sup>a</sup></i>			
	Component		
	1	2	3
Intrinsic1M4		.281	
Intrinsic1M8		.604	
Intrinsic1M15		.661	
Intrinsic2M5		.653	
Intrinsic2M10		.683	
Intrinsic2M18		.604	
Intrinsic3M7		.657	
Intrinsic3M14		.772	
Extrinsic1M6		.706	
Extrinsic1M11		.682	
Extrinsic1M13		.753	
Creativity_2	.630		-.302
Creativity_4	.427		
Creativity_5	.723		
Creativity_6	.694		
Creativity_7	.652		
Creativity_13	.300		
Creativity_15	.619		
Creativity_16	.476		
Creativity_17	.817		
Creativity_18	.711		
Creativity_19	.607		
Creativity_23	.683		
Creativity_25	.367		
Creativity_27	.396		
Creativity_28	.578		
Innovation_1			.884
Innovation_2			.867
Innovation_3			.772
Innovation_4			.630
Innovation_6			.633

Extraction Method: Principal Component Analysis.  
 Rotation Method: Oblimin with Kaiser Normalization.  
 a. Rotation converged in 5 iterations.

<i>KMO and Bartlett's Test</i>		
Kaiser-Meyer-Olkin Measure		.693
Bartlett's Test of Sphericity	Approx. Chi-Square	1361.841
	df	465
	Sig.	.000

## Appendix H

Tolerance and VIF statistics for hypothesis 1, 2a and 2b.

<i>Coefficients<sup>a</sup> H1</i>			
Model		Collinearity Statistics	
		Tolerance	VIF
1	Gender	.868	1.151
	Position	.719	1.392
	Age	.687	1.455
	Tenure	.617	1.620
	Education	.882	1.133
	Firmsize	.850	1.177
	Firmage	.941	1.062
	Intrinsic Motivation	.285	3.513
	Extrinsic Motivation	.291	3.433
	Average		1.771

a. Dependent Variable: Creativity

<i>Coefficients<sup>a</sup> H2a</i>			
Model		Collinearity Statistics	
		Tolerance	VIF
1	Gender	.813	1.230
	Position	.781	1.280
	Age	.569	1.756
	Tenure	.651	1.537
	Education	.875	1.143
	Firmsize	.775	1.291
	Firmage	.953	1.049
	Intrinsic Motivation	.907	1.102
	Creativity	.725	1.379
	Intrinsic*Creativity Centered	.812	1.232
Average		1.300	

a. Dependent Variable: Innovation

<i>Coefficients<sup>a</sup> H2b</i>			
Model		Collinearity Statistics	
		Tolerance	VIF
1	Gender	.812	1.232
	Position	.820	1.220
	Age	.593	1.687
	Tenure	.644	1.553
	Education	.875	1.143
	Firmsize	.815	1.227
	Firmage	.948	1.055
	Extrinsic Motivation	.926	1.080
	Creativity	.201	4.974
	Extrinsic*Creativity Centered	.207	4.820
Average		1.999	

a. Dependent Variable: Innovation

## Appendix I

Left: Interaction between intrinsic motivation, average innovation and low, average and high creativity.

Right: Interaction between extrinsic motivation, average innovation and low, average and high creativity.

